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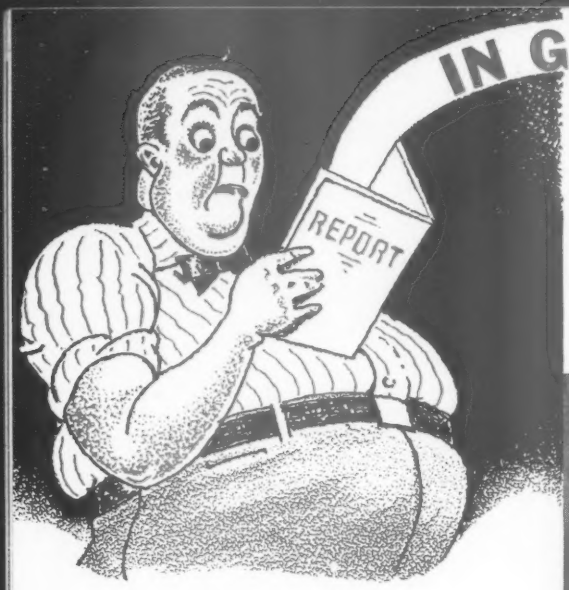

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(STOCK SHORTAGE)

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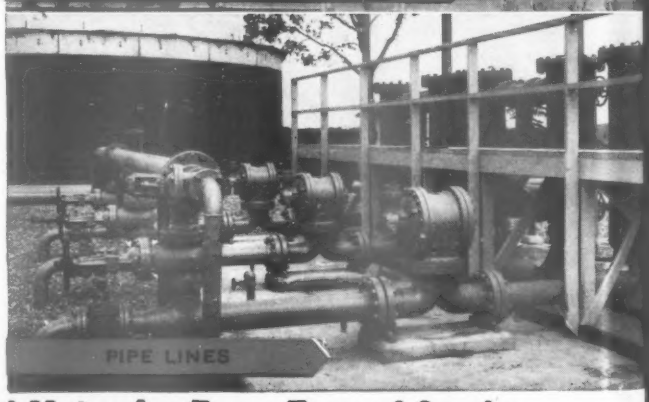

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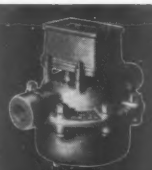

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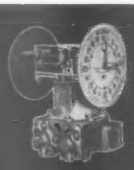

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Table of Contents

NEWS DEVELOPMENTS

Nation's Fields Producing at Maximum Efficient Rate 122
Shortages of Transportation, Materials Threatens Supply 122
Active Rotary Rigs Rise to 1,658, Highest in History 123
Eight Records Reported to PIWC 123
Letters 126
Fuel-Oil Outlook Remains Critical 126
Peak Output of 4,945,400 Bbl. Certified for August 128
Foreign Oil Discussions Resumed 128
Possible Future Oil Pools of Pennsylvania 129
Drilling Forecast—Sharp Increase Indicated 132
Well Completions Increase 30 Per Cent First Half of 1944 135
Production Increases 100,742,000 Bbl. 137
Record-Breaking Refinery Requirements Face Industry 139
Extensive Pipe-Line Construction Will Continue 141

Trends 121
This Week 125
Editorial 127
Deaths 131
Refining News 203
Pipe-Line News 207

ENGINEERING AND OPERATING

Design and Construction of Santa Maria Valley Plant 145
Compact and Enclosed Water-Flood System 148
Surface Cavities Are Proven in Bateman Field 151
Thermal Reforming for Olefin Production 157
Improvement of Octane Rating of Gasoline 165
Derrick Steel Used for Pipe Rack 178
Questions on Technology 189
Practical Refinery Engineering—6 Heat-Transfer Coefficients 197

Plant Practices 154
Books 176
Eng. Fundamentals 193
Refiner's Notebook 195

EXPLORATION AND DRILLING

Week's Highlights 211
Completions in All Areas 211
Reports by Areas Start on Page 212
Daily Average Production for Week 212
Summary of June Completions 229
Wildcat Completions and Discoveries 229

ADDITIONAL FEATURES

Drilling Contractors 230
Market Summary 231
Crude-Oil Prices 231
Calendar of Events 231
Personals 232
Equipment Progress 234
Classified Advertising 235
Index to Advertisers 238

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reasonable..."

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ile the equipment is up
nd the crew on hand, we can
eave the casing in smooth
lean condition for any
future work."

"It sure does take a load off
mind to <u>know</u> that the casing i
scraped to its full I.D., and a
smoothed up and clean."

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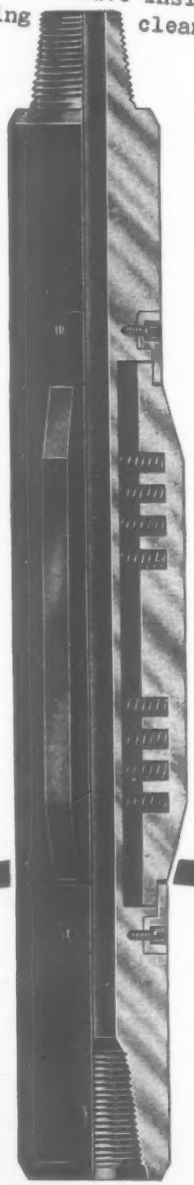

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BAKER ROTARY CASING SCRAPE

the OIL AND GAS JOURNAL

Trends

Crude-Oil Production
By States—Page 212

CRUDE-OIL STOCKS 226,513,000 bbl. as of July 15—up 89,000 bbl. One year ago 237,440,000 bbl.

GASOLINE STOCKS 82,252,000 bbl. as of July 15—down 1,457,000 bbl. One year ago 75,391,000 bbl.

RESIDUAL FUEL-OIL STOCKS 54,332,000 bbl. as of July 15—up 646,000 bbl. One year ago 66,871,000 bbl.

GAS OIL AND DISTILLATE STOCKS 37,171,000 bbl. as of July 15—up 982,000 bbl. One year ago 33,079,000 bbl.

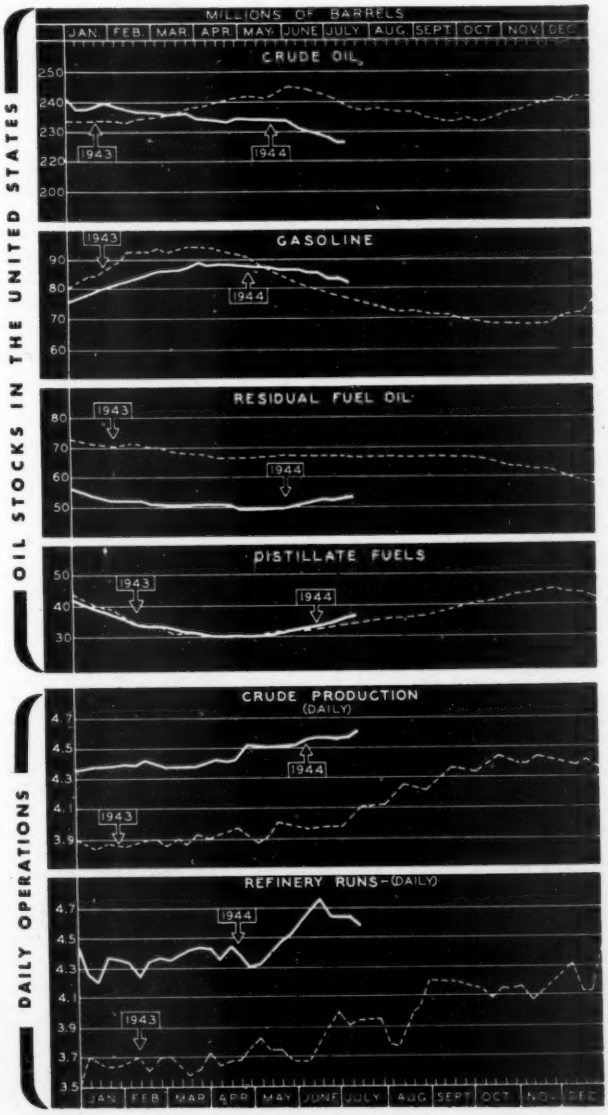
CRUDE-OIL PRODUCTION 4,622,400 bbl. daily average week ended July 22—up 28,800 bbl. Year ago 4,116,570 bbl.

REFINERY RUNS 4,575,000 bbl. daily week ended July 15—down 70,000 bbl. Year ago 3,943,000 bbl.

IN projecting a record production of liquid petroleum for the new month starting Tuesday the Petroleum Administration for War frankly acknowledged that the carrying out of this program will result in certain fields in Texas "exceeding the maximum efficient rates of production." As has been the trend for many months, most of the August increase is to come from Texas, where operators have contended that important sources of crude oil were being produced without regard to conservation regulations established by the Texas Railroad Commission. It is also noteworthy that the August production in three states—Louisiana, New Mexico and Mississippi—will be less than the July projection.

IT is explained by PAW that a "military urgency" is responsible for the continued high rate of production next month. Increased activity on all the major war fronts has brought demands for products which must be supplied. Unofficially it is stated that these demands are so urgent that there is not time enough to make effective plans which call for increased crude-oil supplies from South American countries. It is pointed out that increased demands center in the light products—aviation and all-purpose gasolines, diesel fuels and special grades of lubricants—and these are not readily obtainable from the low-gravity and high-sulfur crudes which predominate in most of the additional supplies available in this hemisphere.

A FACTOR in present Washington planning for the oil industry, it is stated, is the probability that the end of the European war is a matter of weeks rather than months. It is explained that should the European conflict end during the fall, continued emphasis on domestic supplies for increased requirements is the logical operating procedure regardless of the fact that the future productivity of certain fields will be sacrificed. This program, it is emphasized, will postpone shipping and manufacturing problems involved in increased imports and also assist in the solution of manpower and materials difficulties. Should an early end of the European war prove to be wishful thinking a longer-range program will be revived based on the common agreement that the peak in the total productivity of domestic fields has been reached or passed and other sources of supplies should be drawn upon.



Nation's Fields Producing at Maximum Efficient Rate

by Henry D. Ralph

WASHINGTON. — Warning was given the nation last week that domestic oil fields have reached their maximum efficient rate of production and that stocks of crude in District 5 (California) are at minimum safe working levels. These danger signs were pointed out by Ralph J. Schilthuis, assistant director of production, Petroleum Administration for War, who reported on the current status of producing operations to the regular meeting of the Petroleum Industry War Council.

Upward revisions in military requirements, Schilthuis explained, indicate constantly increasing demand for petroleum and that the demand is in excess of current and programmed production.

Rising demands, the council declared in a resolution adopted after hearing Schilthuis' report, require that the petroleum industry must be provided with necessary materials and equipment. The industry can carry out its assignment only if the flow of materials as now programmed is met in full and by increasing the supply of numerous items such as drill pipe, tool joints, engines, trucks, heavy-duty tires, and heavy drilling equipment, the PIWC resolution asserted.

The council authorized its officers to focus attention of the PAW and all other governmental agencies having jurisdiction over the allocation of material on the critical situation now facing the petroleum industry in its efforts to meet increased requirements for crude oil.

"The PAW," said the preamble to the resolution, "established a well-drilling program for the year designed to meet essential petroleum requirements, which had been estimated at 4,358,000 bbl. daily in the third quarter and 4,326,000 bbl. daily in the fourth quarter. PAW has found it necessary to certify to the oil-producing states and to the industry that 4,656,300 bbl. daily of crude oil must be produced in the United States during August in order to meet greatly increased military and essential civilian demands."

These higher objectives, the PIWC held, cannot be met unless the war agencies in control of materials, manpower and transportation make available to the industry all necessary facilities required for accelerated operations.

William B. Heroy, director of PAW foreign producing operations, reported tankers and materials were the most critical facilities in the program to increase production in the Caribbean area. Only 78 rigs are in actual operation in the Caribbean area, Heroy reported, out of a total of 110 listed as active.

An analysis of dry-hole frequency presented by Schilthuis shows that the increased percentage of failures is not entirely owing to the wider spacing required by PAO-11 and companion orders.

Data developed by the dry-hole analysis covered the trend in the ratio of total wells drilled to oil wells completed for 3 years before issuance of spacing orders and the 2 years of operation under M-68 and PAO-11. Results of the study show that a minimum of 10 per cent additional acreage per oil development well drilled in District 3 should have been developed during 1942 and 1943 to maintain parity with the years 1939 through 1941 in order to offset the increased percentage of dry holes drilled in the past 2 years.

A study has been completed for Texas to determine the actual acreage developed per successful oil well drilled during the two periods under comparison. The 14,600 successful oil development wells completed in Texas during 1940 and 1941 increased the proved acreage by an average of 18.1 acres per well. The 5,433 successful oil development wells completed in 1942 and 1943 averaged 39.8 proved productive acres per well. On this basis, there was an increase of 120 per cent in the amount of acreage developed per successful oil development well drilled as compared with the 10 per cent additional acreage determined as being the required minimum to offset the increased proportion of dry holes in District 3 as a whole.

Shortages of Transportation and Materials Threaten Oil Supply

WASHINGTON. — The petroleum industry is breaking all records in crude production, refinery operation, and output of war products, but is seriously threatened by shortages of materials and transportation facilities, it was declared by Petroleum Industry War Council at its July meeting here last week.

Resolutions were adopted asking government agencies for higher allocations of truck tires for oil transportation, and for increased supplies of heavy drilling equipment, and it was voted to participate in a government educational campaign to promote further conservation of fuel oil during the coming winter.

The committee on petroleum economics reported the present record-breaking achievements, but warned that continued heavy military demands would tax the industry's facilities to the utmost and that local shortages in supplies are possible. At the next council meeting this committee expects to have a detailed forecast of supply and demand for the coming year.

The council voted to hold its next scheduled meeting in Washington September 13.

William R. Boyd, Jr., chairman of the council, said there are more than 200 petroleum transport trucks completely out of service and the situation is daily becoming more critical because of a shortage of heavy-duty truck tires. This condition, he said, aggravates an already grave inadequacy of petroleum truck transports.

"The Office of Defense Transportation prohibits transportation of petroleum products by railroad tank cars under 200 miles without special permit, which makes truck transportation of petroleum even more essential," Boyd explained. "The railroad tank-car supply is now estimated to be 6,000 cars short, which makes the granting of special short tank-car hauls impracticable. On short hauls one large truck transport does the work of at least a dozen railroad tank cars."

Tank-Car Situation Critical

Boyd explained further that should it become necessary to press railroad tank cars into services ordinarily performed by the demobilized petroleum truck transports and others threatened with withdrawal from the highways, to supply farmers with petroleum necessities for war food production, there would be fewer railroad tank cars for important invasion deliveries to East and West Coast ports.

The council adopted a resolution

declaring that prompt allocation by the federal Government of an adequate number of heavy-duty truck tires is the only means of avoiding further disintegration of the petroleum transport service.

Another resolution proposed that a joint campaign be launched by OPA, PAW and the oil industry to give dealers and consumers the facts regarding the shortage of fuel oil, which is expected to necessitate rationing during the winter of 1944-45. It authorized PIWC to appropriate not more than $5,000 to cover the cost of pamphlets and other informative material for use as part of such a campaign.

Active Rotary Rigs Rise to 1,658, Highest in History

WASHINGTON. — Although there was a slight increase in production of drill pipe in the second quarter of 1944, it was offset by the increase in the number of rotary rigs in operation, thus heightening the difficulties of a problem which already had become grave, according to Claude P. Parsons, director of materials, Petroleum Administration for War, in his report on materials required for petroleum-industry production operations. As claimant agency for the petroleum industry, PAW has just prepared its estimate of fourth-quarter requirements of critical war materials. It will present them as a formal claim before War Production Board.

There were 1,330 rigs operating in the first quarter and 1,502 in the second. At the present time there are 1,658 rigs operating. As there is no chance for increased production of drill pipe for the rest of 1944, this sharp increase in drilling rigs may further aggravate the drill-pipe problem, as well as other tight items such as tool joints.

The light-truck situation is becoming "very critical," Parsons says, owing to the fact that the pool of these vehicles frozen at the start of rationing in March 1942 has been exhausted and no light-truck production has been authorized by WPB since that time. It is hoped that within the next 90 days military requirements will make cutbacks, possibly permitting authorization of some light-truck production for civilian use. Medium trucks are being produced as planned, but the heavy-truck program is falling behind, owing mainly to shortage of castings.

Following formulation of the emergency truck plan, district offices of PAW were directed to inform all oil operators to submit on or before July 15 copies of their applications for needed trucks which they were unable to obtain through other sources. These applications have been forwarded to the Washington office for compilation to determine an actual industry program by makes and models of trucks. The program will be prosecuted promptly to conclusion.

Aside from the emergency plan, 1,249 applications for trucks were processed by Office of Defense Transportation covering all branches of the petroleum industry during June, divided as follows:

	Submitted	Approved
Marketing	460	418
Production	459	411
Other liquid products	15	14
Transport	315	227

Approximately 90 per cent were approved.

The current situation with regard to tool joints is worse than previously, there being less production and back orders increased from 220,000 in March to 300,000 in June. A recent strike was settled, which should bring the production up to approximately what it was in March, but unless the new facilities which were approved several months ago start operation in time to increase the production in the fourth quarter, the shortage will be more serious than was expected.

There was an increase in production of pumping units during the second quarter, but the number of back orders increased slightly. In May 846 units were manufactured, compared with 750 in April. The accumulation of back orders was 5,933 in May, compared with 5,744 in April. PAW will continue to work with the manufacturers to obtain delivery of the various components required in making pumping units.

The third-quarter outlook for internal-combustion engines and parts appears somewhat more favorable, Parsons says. Actual deliveries in the second quarter were better than in the first. The improvement, the report says, is due to a continuous effort on the part of the engine section of the materials division to get better recognition from WPB, better scheduling on the part of manufacturers, and increased deliveries to engine distributors. The problem will continue to be extremely critical owing to shortages of castings and components.

PAW has received from WPB further recognition as claimant agency for the petroleum industry in the form of an increased delegation of authority to authorize projects up to $100,000 without submission to WPB. Previously, the delegation was limited to $25,000.

"While the burden of the petroleum operator is relieved," says Parsons in closing his report, "it places upon him an additional obligation to help us justify the position we have obtained for him before WPB. Any abuse of priorities, even by a minority, will certainly react to the disadvantage of the whole industry, in which case we are liable not only to lose the privileges gained but the accompanying loss of prestige will make it extremely difficult to reestablish our former position. The fact that relaxations have been obtained should not be the basis for increased optimism over the immediate future of the materials picture. We will be able to obtain a suitable quantity of materials for the petroleum industry only by putting up a fight and by constant plugging. We must repeat that materials are still tight and that they will remain tight so long as there are major military uncertainties."

Eight Records Reported to PIWC

EIGHT new operating records for June were reported last week before the Petroleum Industry War Council by Dr. Robert E. Wilson, chairman of the committee on petroleum economics. Here are the mid-year highlights disclosed before the twenty-ninth monthly meeting of the PIWC since Pearl Harbor:

1. Crude-oil production averaged approximately 4,560,000 bbl. per day, 50,000 bbl. a day more than in May and almost 600,000 bbl. per day higher than June a year ago.

2. Daily average crude runs to refineries of the United States amounted to 4,670,000 bbl., which is about 200,000 bbl. a day more than the previous month and about 800,000 bbl. per day more than in June 1943.

3. United States production of 100-octane gasoline and its various ingredients reached a new high—the major factor in the 500,000 bbl. daily of this product now being produced by the United Nations.

4. Total domestic production of all gasolines amounted to about 2,020,000 bbl. daily, and of this amount

a greater portion than ever before was special high quality material for the military services. June was the first month in which domestic gasoline production has averaged more than 2,000,000 bbl. a day. In June 1943, the daily output was 1,558,000 bbl.

5. Production of heavy industrial fuel oils, including special Navy grade fuels, exceeded all previous production records, as did that of the gas oil and distillate fuel oil, including special Navy diesel fuels.

6. June witnessed a new high in the total of butadiene made from petroleum for use in rubber manufacture.

7. During the same month movement through both the 20-in. and 24-in. war emergency pipe lines to the East Coast reached a new high record, as did the over-all quantity of crude oil and products received through all pipe lines into the eastern coastal area.

8. The largest total quantity of petroleum and products ever moved to the Atlantic seaboard district in any one week was exceeded twice during June.

The committee submitted a report by districts designed to show how actual supply and demand compare with the last committee forecast.

District 1

In District 1 inventories of gasoline and kerosene are slightly above forecast levels. Stocks of distillates and residual fuel oils are somewhat lower. The differences in stock levels are not any cause for concern. In the case of gasoline, the higher stock levels will prove highly desirable since it is now expected that military requirements and transportation necessities will increase beyond those contemplated in the subcommittee's last report and, domestically, kerosene may be in greater demand during the coming winter because of the types of blends of No. 2 fuel oil which may be necessary.

The District 1 outlook for the third quarter is generally encouraging and it is felt that the industry will have on hand at the beginning of the fourth quarter the level of inventories required to meet minimum essential civilian needs. This, however, is dependent upon the volume of overland transportation that may be required for the movement of military products for export from the Atlantic seaboard to shorten transatlantic tanker hauls.

District 2

Operations in District 2 during the early part of the second quarter fell slightly below the April program in that crude runs to stills were below expected levels. During the first half of June, runs were increased and, for the month as a whole, are on schedule. The inventory situation in the district is close to anticipated levels, but crude-oil stocks increased more rapidly than expected at the expense of refined products. This was, of course, due to lower crude runs to stills during most of the second quarter.

West Texas crude is not being run to the extent hoped for. This is mainly because of insufficient tank cars for transportation to refineries within District 2. It is felt that little difficulty will be experienced in maintaining total runs at 1,185,000 bbl. daily, but increases above this level will depend upon larger receipts of crude oil from West Texas. During the third quarter, District 2 will be called upon to supply increasing amounts of military products. This is particularly true with respect to gasoline and products in the gas-oil and distillate fuel-oil group. While total shipments will probably approximate those expected, the proportion of civilian products will be reduced.

It appears that distillate supplies in District 2 will be tight as a result of the increased demand for Navy diesel and Navy gas oil for military use.

District 3

Crude oil and natural gasoline.—It is estimated that production of crude oil and natural gasoline in District 3 averaged 2,750,000 bbl. daily in the second quarter, compared with the economics subcommittee's previous forecast of 2,725,000 bbl. On the basis used by the district committees, as distinguished from the Bureau of Mines basis, which includes about 25,000 bbl. daily of natural gasoline as crude oil, the estimated production for the second quarter was 2,750,000 bbl. daily of crude and 180,000 of natural gasoline and condensate.

It is now estimated that production in District 3 averages 2,675,000 bbl. daily of crude oil and 200,000 bbl. daily of natural gasoline-condensate in the third quarter, representing increases over the subcommittee's previous forecast for this period of 75,000 and 15,000 bbl. daily, respectively. The PAW certification for July is 2,647,000 bbl. daily of crude oil and 195,000 bbl. daily of natural gasoline-condensate. It is anticipated that production will remain relatively constant during the third quarter, although there may be some slight increase in West Texas crude, if demand and transportation facilities materialize.

Refinery operations.—It is now estimated that refinery crude runs to stills in District 3 during the second quarter were 1,648,000 bbl. daily, or 68,000 higher than the last forecast. This improvement is the result of the satisfactory operations realized on new units, and favorable experience recently with regard to downtime at refineries. It is the higher refinery demand in District 3 that has required increased crude-oil production, for movements of crude out of the district have remained about as anticipated.

The higher level of refinery operations has resulted principally in increased output of gasoline and residual fuel. The output of other products has been almost exactly as estimated. The increase in gasoline production has been particularly marked in the case of 100-octane, and reflects strenuous efforts of the industry to meet military demand.

The latest refinery operating schedules indicate that refinery crude runs to stills in District 3 will be 1,665,000 bbl. daily in the third quarter, or approximately 17,000 bbl. daily higher than the second quarter.

Petroleum stocks.—District 3 stocks at the end of the first quarter were 4,800,000 bbl. less than shown in the last forecast, the difference being due to 3,200,000 lower crude stocks and 2,100,000 lower gasoline stocks.

District 4

General conditions in District 4 at the end of the second quarter, appear to be about as expected when the April report was prepared.

Crude-oil production had been running somewhat lower than expected, but more recently assumed higher levels. The Stanolind Pipe Line Co. line being built from Elk Basin to Casper to connect with the line going east to District 2, is expected to be completed by the end of the third quarter. This should provide pipe-line outlet for the sour crudes of northern Wyoming.

District 5

The situation in District 5 continues to follow the general trend outlined in the subcommittee's report of April 24 except that the present outlook indicates that inventories will decline at an even more rapid rate than expected. This accelerated inventory decrease does not become apparent, however, until after the third quarter, for the reason that a larger crude-oil production than expected and greater receipts than expected from other districts approximately offset the increase in demand forecast for that quarter. Present estimates of the district's production committee show an anticipated crude production for the third quarter of 850,000 bbl. daily; 5,000 more than was expected when the April estimate was made. Receipts from other districts, the major portion of which consists of distillate fuel oils for military use and special residual fuels, are expected to increase to about double those previously estimated.

Press Association, Inc.

Aviation gasoline, bombers and manpower combine to make this Chinese base possible. This particular base is for the Twentieth Bomber command, operating superfortresses against the Japanese homeland

THIS WEEK

PRODUCTION—Another record total of petroleum liquids requested for August—4,945,400 bbl. daily, including 289,100 bbl. of condensate and natural gasoline. . . . ¶Tardy completion of condensate plants forced PAW to exceed planned crude-oil production to meet rising military demand. . . . ¶Industry leaders firm in demanding more materials, in light of stepped-up production schedules. . . .

TRANSPORTATION—Critical situation developing in industry's motor transport. . . . ¶Additional shift of tank cars may occur, aggravating conditions to breaking point. . . . ¶WEP products line scheduled to move 200,000 bbl. daily eastward, 30,000 bbl. over designed capacity. . . . ¶Higher tank-car shipments to California probable later this year. . . . Overland movement of special military products to West Coast pressing 100,000-bbl.-per-day figure. . . .

REFINING—District 2 operators urged to increase yields of light fuels in the gas-oil diesel-fuel range. . . . Interior plants also requested to make greater contribution to war effort by increasing eastern shipments of motor fuel. . . . ¶Specific suggestions made on how to meet 70-octane limitation on housebrand gasoline, by PAW. . . . ¶Base period, regulating volume of premium gasoline, changed for California operators. . . . ¶American refiners confer with British representatives on postwar problems of synthetic rubber. . . . ¶Army intelligence officers assert 70 per cent of German refining capacity destroyed by bomber raids, over a period of months. . . . ¶Control tightened on aviation gasoline and its components, by PAW and Aviation Petroleum Products Allocation Committee. . . .

FOREIGN—Cabinet officers of United States and British governments open oil conferences in Washington. . . . ¶Memorandum of free access to world's petroleum resources, accepted earlier by technical experts, nucleus of higher-level discussions. . . . ¶Arabian pipe-line issue will be finally settled, observers assert, against Administrator Ickes. . . . ¶Several rigs in Caribbean area unable to operate because of equipment shortages. . . .

MATERIALS—Heavy-duty tires for trucks, drilling engines, heavy rigs, drill pipe and tool joints in slightly less favorable supply position. . . . Military orders again forcing interruptions of oil-field supply schedules. . . . PIWC takes adamant stand on materials question—in effect tells war agencies the military-fuel assignment is impossible unless given the supplies with which to work.

DRILLING—Rotary rigs in operation rise to 1,658, compared to 1,502 in the second quarter and 1,330 in first quarter. . . . Another 90 to 100 rigs will be needed to meet projected completion schedule. . . . PAW sees little chance of acquiring additional drill pipe for remainder of the year, leaving higher completion schedules strictly dependent on WPB. . . .

Letters:

Note: This letter from Mr. Cummins has to do with the editorial appearing in the July 22 issue of The Oil and Gas Journal, entitled "A Threat to Independents," which discussed activities of cooperatives in the petroleum industry. The brief reply sent to Mr. Cummins is printed here also.

YOUR editorial writer makes a poor choice of words in "A Threat to Independents" in The Oil and Gas Journal of July 22.

"The record is indisputable," he says, "that cooperatives in effect largely evade federal income and excess-profit taxes."

Uncle Sam frequently puts people in prison who "evade" federal income taxes. Coops are not tax evaders.

In common with editors of other trade publications, you make too much of the fact that cooperative corporations escape federal and state income taxes because they do not have income as such. If private profit business men believe that is an advantage, they can easily contract with their patrons in advance to return to those patrons, at the end of the business year, on an equitable basis, all surplus above all legitimate costs of doing business. The corporation then will not have income as such and will not, therefore, have to pay income taxes. Such taxes will be paid by recipients of the surplus. And if business men do not understand how this can be done, we have an attorney here who is versed in both corporate and cooperative law who undoubtedly will be glad to tell them how it can be done.

The little independents are being squeezed, to be sure, but not by cooperatives. You and I know where the men came from who have key positions in PAW. They came from the majors. You and I know what companies have the bulk of the petroleum business in this country. Again, it's the majors.

Instead of railing at cooperatives, petroleum independents ought to get together and set up nonprofit corporations something like the one I have suggested here. Let them capitalize it, let them drill oil wells, build pipe lines and refineries, and let the nonprofit corporation do the job for them. Whatever surplus the corporation has at the end of the year, after all costs of doing business are met, can be paid equitably to the shareholders. The nonprofit corporation will not then need to pay either federal or state income taxes. These will be paid by recipients of the savings of the corporation.

Independents need to work together. Somebody with economic understanding and organizing ability can do a real job for the independents if they'll lay aside their prejudices and really pool their resources. Economic circumstances in time may compel such collaboration.

Trade publications that speak for independents now and then frequently overlook the fact that cooperatives were forced into being by the relatively high and rigid price structure for petroleum products and other farm supplies following World War I. A recent study by the economics department of the Standard Oil Co. of New Jersey, dealing with the growth of cooperatives, showed clearly what those margins used to be. Farmers, faced with low prices for farm crops, on the one hand, and relatively high and rigid prices for petroleum and related supplies, on the other, were compelled to act as a matter of survival. They did act by setting up cooperatives to buy for them in quantity. That naturally led to the field of manufacturing when manufacturing could be done at a greater saving than could be realized in purchasing from others. Cooperatives were thrust up in order that farm people could dwell in solvency in the midst of mammoths on the industrial side which all too often were enforcing relatively high prices. The independents, in time, if they'll quit taking the word "independent" seriously, may be forced to take the same step that farmers have taken.

There is more to the matter of income taxes in relation to cooperatives than is to be found in the anticooperative rantings of the National Tax Equality Association. One of these days when you or one of your men get to Kansas City I hope you'll come over and have a chat with us. If you do, we'll not even try to sell you a share of preferred stock, although we think it's a gilt-edged investment.

Sincerely yours,
J. W. CUMMINS,
Director of Information.
Consumers Cooperative Assn.

Dear Mr. Cummins:

We were glad to have your comments regarding the editorial appearing in our issue of July 22. Your letter will be reproduced in our issue of July 29. Our readers will be interested in but not impressed with your frank statements regarding the objectives and possibilities of the cooperative movement within the petroleum industry.

We do not question the lawfulness of your tax position. We are familiar with the laws and court decisions which have legalized the "escape" which your organizations have in regard to income and excess-profit taxes. You will agree, I am sure, that there are no tax collections from your membership to offset these revenue losses. We also know that court rulings have indicated that individuals and private corporations could revamp their operating procedure, as suggested in your letter, so that they would also be largely immune from federal and state income levies.

What has never been explained to us—after the arrival of this cooperative Utopia to which you point, involving every economic activity—is how the extraordinary and normal costs of government, including a staggering war debt, would be paid.

Very truly yours,
C. O. WILLSON, editor.

Fuel Oil Outlook Remains Critical

WASHINGTON.—Supplies of fuel oil for civilians in 1944 will be no greater than in 1943, when use of fuel oil was rationed in 33 states, the Petroleum Administration for War and Office of Price Administration reported here last week in analyzing the outlook for supplies next winter.

Although petroleum output is at an all-time high this year, military needs are estimated at one-quarter of the available supply, with civilian needs to be met from a supply approximately one-fifth less than in 1943; and much of the civilian supply must go to war plants, PAW and OPA said.

According to these agencies, essential war requirements in 1944 have increased to the point where there will be an actual shortage of fuel oil for civilian use, comparable to the deficit caused by a variety of transportation difficulties 2 years ago.

The amount of oil needed for prosecuting the war is subject to violent fluctuations growing directly from military operations, OPA and PAW reported. The stupendous requirements for military needs are indicated by the estimate that petroleum products account for fully half of the total tonnage of supplies necessary to support an expeditionary force, PAW and OPA said.

According to PAW and ODT, transportation of fuel oil is in a more flexible situation in 1944 than it was in 1942. Although tankers, which formerly provided 95 per cent of the East's petroleum supply, are bringing in less than 10 per cent this year, tank cars, which in 1941 carried only 5,000 bbl. a day, are currently transporting close to 750,000 bbl. a day.

Barges, inland shipping, pipe lines owned by industry are being used to the full; while the big-inch line from Longview, Tex., to New York and Philadelphia, and the little big-inch connecting Beaumont, Tex., and Linden, N. J., are pouring oil and other petroleum products east at a rate of approximately 475,000 bbl. per day, PAW reported.

PAW explained that movements of petroleum products to the East Coast by rail, truck, pipe line, barge, and tanker are fixed at a fairly steady rate of approximately 1,700,000 bbl. a day.

This amount, however, is insufficient to meet peak winter demands without extensive storage, PAW said. Movement of petroleum products as reported by barrels per day does not provide a complete index to civilian-supply prospects, PAW warned, because on some days all or almost all of the material transported will be military requirements.

During the summer of 1943, stocks in storage on the East Coast reached a peak of approximately 4,700,000 bbl. of kerosene; 14,600,000 bbl. of fuel oil for home heating; 9,800,000 bbl. of residual fuel oil for industry, PAW reported.

The agency expects to exceed these stocks in 1944, but it will be necessary to use every available inch of storage space to do so. Early in May 1944, PAW reported, a large number of industry storage tanks were turned over to the military.

Sinclair-Wyoming Posts Tensleep Crude Price

The Sinclair-Wyoming Oil Co. announces that it will pay $1 per barrel for Tensleep oil only, Lost Soldier field, Wyoming, effective April 26, 1944.

FOUNDED IN 1910

BY PATRICK C. BOYLE

the OIL AND GAS JOURNAL

Postwar Transportation

EVERY week brings new reports revealing how the transportation division of the petroleum industry is meeting new demands and literally keeping the Allied war machine from bogging down of its own weight in these climactic days of a world conflict. In this country more petroleum is being transported than ever before.

New records in tanker movements are established monthly, with shipments to the war fronts on schedule regardless of difficulties encountered. The sea of oil which was credited with winning the other war is now in full tide in this one.

But many who are familiar with what has been accomplished over the past 2½ years are concerned that more thought is not given to what will be done with this mammoth system after the war. A few figures will reveal the status of today's transportation facilities which shortly must be adjusted to peacetime operations.

Government reports based on 123,855 miles of crude-oil lines and 14,413 miles of product lines show that present movements are at a rate in excess of 280,000,000 tons yearly, or approximately 60 per cent of the coal tonnage shipments, the largest user of this country's railroad systems. Last year the rail shipments of crude oil and products totaled 84,875,255 tons, or 6 per cent of all the business of the Class 1 roads.

On the Great Lakes and inland waterways in 1942, the latest report available, petroleum contributed 63,994,097 tons or 10 per cent of the total. The petroleum shipments in 1943 and so far this year were substantially greater. The American Trucking Association estimates that 10 per cent of all trucking is accounted for by petroleum.

By the end of this year more than 600 tankers will have been built in this country since Pearl Harbor. They represent more than 8,000,000 deadweight tons, or more than twice the total tanker tonnage of this country in the early part of 1941. Despite the losses to the enemy, this country's tanker capacity at the close of the war will nearly equal that of the entire world in 1939.

Problems other than those emanating from increased capacity will come with the close of the war. There is the matter of the Government's ownership of a large part of the new pipe lines centering in the 24 and 20-in. lines. Most of the new tankers will be owned by the Government, including large investments in inland waterway facilities. There is the further fact that with the end of the war the industry will begin to realize the full significance of operating a large part of its pipe-line transportation system under a governmental consent decree.

The first thing to be done in deciding on a program for the future is for the petroleum industry to stop considering its transportation activities as appendages to its other operating divisions. Petroleum transportation in the future must stand on its own feet. Too many things have happened to regard its solely as an auxiliary to the production, refining or marketing divisions.

Petroleum transporters must coordinate their varied activities so that they can present a solid front when attacked by competing operations. Government must realize that when it harasses operators with unwarranted regulations it is impairing a service which has had and will continue to have a major role in this country's economy. This industry must make a complete analysis of its transportation and get ready for realities ahead.

Peak Output of 4,945,400 Bbl. Daily Certified for August

WASHINGTON.—An all-time high production rate of 4,945,400 bbl. daily of all petroleum liquids last week was certified to the various oil-producing states for August.

This represents a net increase of 37,700 bbl. daily over the rate certified for July production and is approximately a 500,000-bbl. per day increase over actual production a year ago.

In the southwestern states (PAW District 3) Texas received a net increase of 33,000 bbl. per day over July certifications to compensate for unforeseen delays in completion of natural-gasoline facilities in Louisiana and decreases in crude-oil productive capacity in Mississipi and New Mexico. Louisiana's certification was reduced by 10,000 bbl. from the July certification, Mississippi's by 1,000 bbl., and New Mexico's by 2,500 bbl.

"The urgency of military requirements has made it necessary to certify, as a matter of war necessity, a rate of production for Texas during August, which, in the technical opinion of PAW, may well result in exceeding the maximum efficient rates of production for some fields in that state," declared Ralph K. Davies, deputy petroleum administrator.

For California (PAW District 5), the rate certified is 12,900 bbl. daily more than that for July. The major portion of this increase is attributable to new well completions and to actual production performance in unrestricted fields.

In the Rocky Mountain states (PAW District 4), the rate for August calls for an increase of 5,000 bbl. daily over the quantity certified for July. This increase will permit sufficient current production to meet increased requirements for black crude oil, which can now be moved with additional transportation facilities that have been recently made available.

Rates of production certified to the eastern and midwestern states (PAW Districts 1 and 2) remain practically unchanged. The wells in these areas appear to have reached the maximum production capacity as indicated by actual production trends.

PRODUCTION RATES IN BARRELS PER DAY

	Certified total petroleum liquids	
	August	July
District 1:		
New York	12,800	12,800
Pennsylvania	41,800	41,800
West Virginia	13,800	14,000
Total	68,400	68,600
District 2:		
Illinois	226,500	226,500
Indiana	14,000	14,600
Kansas	278,300	279,000
Kentucky	25,500	24,200
Michigan	51,400	51,200
Nebraska	1,000	1,000
Ohio	9,100	8,800
Oklahoma	359,000	359,000
Total	964,800	964,300
District 3:		
Arkansas	82,500	82,500
Louisiana	385,000	395,000
Mississippi	40,000	41,000
New Mexico	115,500	118,000
Texas	2,237,000	2,204,000
Total	2,860,000	2,840,500
District 4:		
Colorado	7,900	7,400
Montana	24,200	24,700
Wyoming	103,000	98,000
Total	135,100	130,100
District 5:		
California	917,100	904,200
Total U. S.	4,945,400	4,907,700

Foreign Oil Discussions Resumed

WASHINGTON.—Formal negotiations with the British Government looking toward a postwar world-wide petroleum agreement were opened here this week at the State Department.

The negotiations are described as conversations on the cabinet-policy level, and the delegations include high-ranking officials of United States departments and war agencies and ministers of the British Government. The discussions opened July 25, and were expected to continue for several days.

Basis for discussion is a memorandum of understanding agreed upon last May by a group of technical experts on petroleum representing both governments. As made public at that time, this memorandum was somewhat vague, but pointed toward understandings among all oil-producing nations for freer but orderly development and distribution of the world's petroleum resources without monopolistic controls.

It is not known whether the discussions will lead to a formal treaty which will need Senate ratification, or simply an executive agreement or general understanding, but in any case the State Department has promised to report the results to the Senate's special committee on petroleum resources.

The Petroleum Industry War Council, meeting here last week, asked the State Department to appoint an advisory committee from the oil industry to assist in the negotiations in the same way that a delegation from PIWC assisted the technical experts in their deliberations last spring. However, it is not believed that the industry will be called into consultation at present since the current negotiations are supposed to deal with matters of international relations rather than with technical petroleum matters, and it may be significant that the British delegation contains only government officials without connections with the British oil industry.

Members of the delegations are:

United States: Secretary Hull, chairman; Secretary Ickes, petroleum administrator, vice chairman; Secretary James V. Forrestal, Navy; Under Secretary of War Robert P. Patterson; Leo Crowley, foreign economic administrator; Charles E. Wilson, vice chairman, War Production Board; Ralph K. Davies, deputy petroleum administrator; Charles Rayner, petroleum adviser, Department of State; Harry C. Hawkins, director, Office of Economic Affairs, Department of State, adviser to the United States delegation; James C. Sappington, assistant chief, petroleum division, Department of State, executive secretary of the United States delegation, and John A. Loftus, petroleum division, Department of State, recording secretary of the United States delegation.

United Kingdom: Lord Beaverbrook, Lord Privy Seal, head of delegation; Richard Law, minister of state; Goeffrey Lloyd, parliamentary secretary to the Ministry of Fuel and Power; Ralph Assheton, financial secretary of the treasury; Sir William Brown, chief technical adviser to the United Kingdom delegation, and Victor Butler, secretary of the United Kingdom delegation.

Many Sentenced in Black Market Drive

WASHINGTON.—Fifty persons have been sentenced by the courts this year to at least a year in jail in the fight against the black market in gasoline, according to the Office of Price Administration.

OPA said the enforcement record from January 1 to June 1 shows that considerable headway is being made in rounding up the criminals at the top of the black market rings that at one time were siphoning off an estimated 2,500,000 gal. a day of the civilian gasoline supply.

Possible Future Oil Pools Of Pennsylvania

*by R. E. Sherrill**

New concepts of Pennsylvania possibilities expressed in this paper which was delivered before the Pennsylvania Grade Crude Oil Association's annual meeting in Pittsburgh June 16 are especially significant since announcement of the subsidy of 75 cents per barrel for crude produced in the region. Furthermore, certain aspects of eastern geology tie in with the current leasing campaign along the Atlantic seaboard which will be followed up eventually with an extensive exploration campaign.

SINCE 1936 your state geologic survey has been actively mapping the oil fields of the state, especially the Middle District, and much study and surveying of them and of the gas fields was done before that. Yet we are not now prepared to answer with satisfactory conviction the question of further oil possibilities. One reason for this is that the primary purpose of the work we have done was to assemble data helpful in recovering more oil from the old pools—not, so much, to determine where possible new pools might lie. The operators have been, and probably are now, more interested in learning more about their producing properties than in considering the possibilities of inadequately tested areas and horizons. Largely for this reason many of the data bearing on the question of possible future oil of the state have not been collected. Many other data, such as samples from numerous wells and complete logs of wells where only the producing sand was recorded, are permanently lost. This is no apology for nor criticism of what has or has not been done—rather it is to warn against accepting or rejecting too readily any opinions based on data thus far assembled.

Statistics show that about 5 of 6 wildcat wells are dry holes even in great oil districts like the Mid-Continent and Gulf Coast. The odds are heavily with anyone predicting that any particular wildcat or limited area will be nonproductive. Without completely overlooking the discouraging features, however, I shall here attempt a more optimistic outlook. If we do not visualize possibilities we shall not be able to approve wildcat ventures which fly in the face of statistical odds nor help to direct the wildcatter's attention to the more favorable areas. The possibilities I shall mention are only possibilities — not necessarily probabilities. Together they seem to me to add to a probability that there are significant undiscovered oil pools in Pennsylvania.

These possible future oil pools fall into two categories: shallow and deep. We shall briefly consider them under these headings, and shall then consider the possibility of finding them, but neither time nor data suffice to consider all possible horizons and areas nor any one in detail.

Shallow Possibilities

The shallow oil possibilities are in the upper Devonian and higher sands. All the commercial oil production of Pennsylvania to date has come from shallow sands. Pools are of the stratigraphic type in which porosity pinchouts in sand control the accumulation. Their location and general stratigraphy are shown in Fig. 1. The Bradford pool and the Middle District as outlined in Fig. 1 have been surveyed in detail and reconnaissance surveys have been made of the other pools.

The Permian, Pennsylvanian and Mississippian sands in the upper part of this group of shallow sands are surprisingly little known. I say surprisingly because tens of thousands of wells have penetrated these sands but, except where they are productive, the information that these wells should supply has either been lost or has not been assembled and analyzed. In southwestern Pennsylvania some of these upper sands, like the Berea and Big Injun, have produced considerable oil and periodically small new pools are found in them. During the past year the U. S. Geological Survey has been studying the Mississippian — espe-

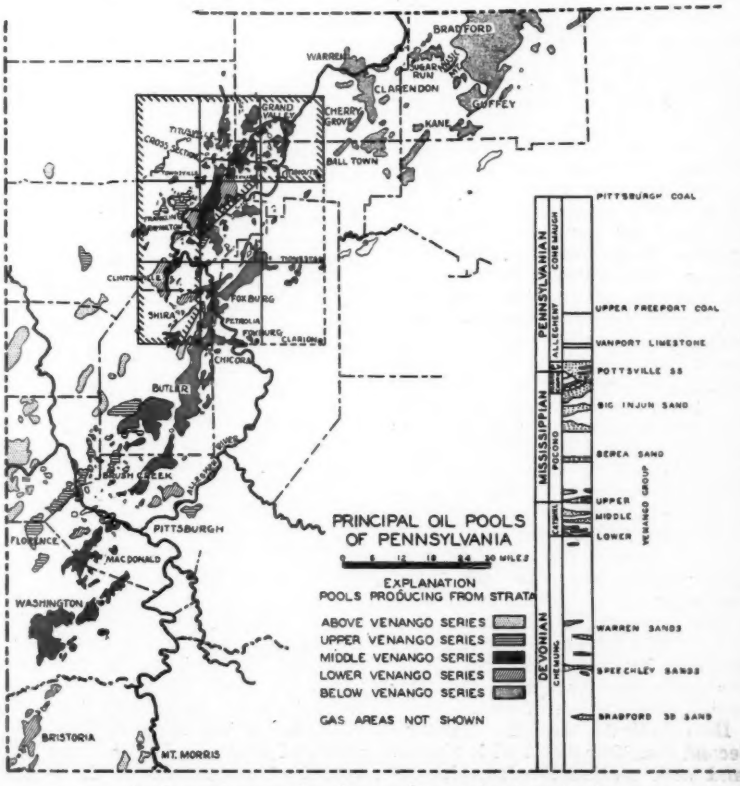


Fig. 1: Eastern fields and type log of producing sands

*Head of the geology and the oil and gas departments, University of Pittsburgh. Presented by permission of the Pennsylvania State Geologist at the twenty-first annual meeting of the Pennsylvania Grade Crude Oil Association.

cially the Berea—in eastern Ohio. Perhaps this work will be extended eastward and favorable areas may be disclosed for Berea or higher new production in southwestern Pennsylvania but this is only a possibility. The well density in southwestern Pennsylvania is much less than that further northeast but the wells are sufficiently dense that major shallow pools of wide areal extent are not to be expected. In considering the area necessary for an important pool, however, remember that Music Mountain, which from August 1937 to the end of 1942 produced 3,796,000 bbl. of oil, covers only 670 acres and ranges between 800 and 2,000 ft. wide. Many other important Pennsylvania producing areas are of comparable extent and many untested areas of this or greater extent exist in western and southwestern Pennsylvania. Data to show where these untested areas lie are being accumulated.

Sand Conditions

The Venango, Warren, Bradford and other upper Devonian sands are much better understood at present than shallower or deeper horizons because the oil work of your state geologic survey has been almost entirely on them.

One conclusion is that oil men have already done a rather thorough job of prospecting along trends and between gaps in producing areas in each shallow sand wherever these sands were correctly correlated. Perhaps it is not out of order to digress momentarily at this point to call your attention to the fact that the obvious trends and the obvious structures have been prospected long ago throughout all the oil districts of the United States. We shall get nowhere looking for obvious things that the other prospector overlooked. For several years now it has been through boldly following up in every way possible the intangible clues, such as the absence of some sand in the cuttings of a well updip from places it is known to be present and other still less tangible clues and deductions, that has led to finding pools. These intangible clues have generally been ignored by the Pennsylvania driller. They are generally not recorded and samples are rarely kept. Even so patient piecing together of the data available and not hesitating to use imagination elsewhere leads to the conclusion that it is entirely too early to decide that the last important Venango, Balltown, Bradford or other upper Devonian pool has been found.

Data indicate that the Venango Second Sand-Nineveh belt is a beach sand with continental desposits occurring at that horizon to the southeast and to the northwest, where productive offshore bars like those of the Third Venango sand might lie, has been little prospected below the Berea. In other places of similar possibility the wells have stopped short of potential shallow horizons giving a false picture of dry-hole density. Other possibilities arise through failure in earlier prospecting to correctly correlate sands. After carefully correlating the Lyttle or Rosenberry sand of the Hilliards quadrangle situations were found where the few wells penetrating it had favorable shows and, in some instances, were producers, but the sand was generally miscorrelated at the time of drilling and its possibilities not investigated further. Also other pools like Raymilton opposite gaps in bars could readily have been overlooked as they lie northwest of the main oil belt. A recent Speechley - Clarendon - Balltown sketch map prepared by L. S. Matteson from published and other data already at hand indicates that this sand offsets en echelon to the east when followed southward and suggests that in the southern part of the state it may have been prospected principally on trend rather than offset to the east where it is more likely to occur. The Venango belt offsets in this direction also from Clintonville to the Butler Cross-belt. East and south of the Bradford pool has been insufficiently investigated in the upper horizons. Small oil pools and larger gas pools in this area indicate the possibility of more production in that direction. The well-established fact that the Devonian sands become progressively lower stratigraphically to the east and southeast seems sufficient evidence that not as much production should be expected above the Kane or Elk sands in this area as in or below these. Areas extensive enough to contain major pools and in which very little, if any, drilling has been done to the depths at which possible shallow sands may lie occur in this part of the state.

Deeper Possibilities

Turning to the Oriskany and deeper sands and limestones moves attention from the insufficiently known to the less known, from expensive to very expensive drilling depths and, perhaps, from the possibility of new minor pools to the possibility of major pools.

These rocks have produced much oil in Kentucky and less in Ohio; and only gas has been commercially produced from them in Pennsylvania. Oil shows have been encountered in them in several Pennsylvania wells. We are not, therefore, prepared to conclude that they are devoid of commercial oil in Pennsylvania but there is little to commend them.

Perhaps we should look no deeper than the Oriskany and Onondaga, nor even that deep, if it is oil rather than gas we seek.

For diverse reasons it has been frequently stated that the deeper rocks will contain only dry gas if any hydrocarbon is present. This is, however, in the realm of theory similar to concepts which long delayed search for oil below the Mississippi lime in Oklahoma. Certainly it is unsafe to conclude that rocks below the Oriskany can produce only gas because the Oriskany is primarily a gas sand. By similar analogy it might be concluded that sands lower than the Murraysville will yield only gas because it is primarily a gas sand yet the main oil sands of this state are lower than the Murraysville. The factors determining whether a rock will contain oil with gas or gas alone and where it will contain one in preference to the other are complex and only partly understood. The fact that limestone oil is, with rare exception, heavier than oil in sand of equivalent depth and age suggests, however, that the more favorable deep oil possibilities may be in the limestone.

Deeper Porosity Doubted

Porosity is necessary to contain and permeability to yield oil commercially. Many wells, shallow and deep, have failed for lack of porosity and permeability in the objective horizons. The major concern generally expressed regarding the deep horizons is that they lack the porosity, and it is often assumed that the deeper the rocks the lower the porosity. This matter of porosity is not thoroughly understood and here again it could be discussed and argued at great length. I shall, however, only mention a few facts which seem to me to be pertinent in this connection. The first is that the shallow Venango sands are soft, porous and permeable in the productive pools while they are very "tight" and quartzitic elsewhere. There seems to be a direct relation here between grain size and porosity but depth apparently has nothing to do with it. Even as seen at the surface at numerous places in western Pennsylvania the Pottsville and Pocono sands are often so cemented with secondary silica that if encountered in wells they would likely be called quartzites and hope abandoned for porosity at that or greater depth. A second pertinent fact is that rocks of the same age as the deepest considered here (Ordovician), and of the same lithologic character so far as known, are porous, permeable and very productive of oil in the Mid-Continent at depths as great as here considered and in

(Continued on page 221)

California Urged to Permit Tideland Wells

WASHINGTON. — Deputy Petroleum Administrator Ralph K. Davies has again urged the California State Lands Commission to start a new directional drilling program in the Los Angeles Basin area and off the shores of Ventura and Santa Barbara counties. In a July 15 letter, Davies reiterated the position taken last October by PAW on California offshore oil development asking the commission to take every action possible to develop offshore oil pools through "that type of directional drilling which has proved so successful over the past 10 years."

The crude-oil shortage in California is becoming increasingly critical, Davies asserted, and California fields are producing at maximum efficient rate, reaching an all-time peak production of about 850,000 bbl. a day. Nevertheless, California crude stocks are being drawn upon heavily, and are approaching minimum safe working levels. The additional production expected from Elk Hills will not meet the need, and additional crude supplies must be provided promptly, if refinery operations are to proceed as desired.

No major oil field has been found in California since 1938, Davies pointed out, in spite of an expanded program of geophysical and geological surveying and exploratory drilling. Structures favorable for oil under the tidelands of California have been found in the Los Angeles Basin area, from the Torrance and Wilmington fields southeast to the Huntington Beach field, and possibly extending to Newport Beach.

"Similar excellent possibilities lie along the Santa Monica Bay shore line and immediately off the coast in Santa Barbara and Ventura counties," Davies said. "These favorable structures can and should be tested and developed by directional drilling from the uplands without endangering the beaches or interfering with navigation and fishing."

Contracts Are Awarded for Seven Large Tankers

WASHINGTON. — Seven large tankers are among 262 additional ships for which contracts have been awarded at the urgent request of the joint chiefs of staff. In announcing the contracts U. S. Maritime Commission said the vessels are vitally needed for prosecution of the war and all must be completed before July 1, 1945. Contract for the tankers went to Alabama Dry Dock & Shipbuilding Co., Mobile. They will be of the commission's T-2 type. Contract for eight of these tankers, to be built by Marinship Corp., Sausalito, Calif., was announced June 12.

OPA Announces Changes In Ceiling-Price Rules

WASHINGTON.—Six changes in the regulation establishing ceiling prices for fuel oil, gasoline and liquefied petroleum gas, each affecting only a particular area of the country, are announced by Office of Price Administration, effective July 31:

1. Tank-wagon ceilings for kerosene, No. 1 fuel oil, range oil and Nos. 2, 3 and 4 distillate fuel oils in District of Columbia apply to the entire Washington, D. C., tank-wagon area. This area comprises Arlington and Fairfax counties in Virginia, and Prince Georges and Montgomery counties in Maryland, in addition to the District of Columbia.

2. In Mount Kisco, N. Y., the tank-wagon ceiling for kerosene, No. 1 fuel oil, and range oil in lots of 25 gal. or more is established at 10.3 cents per gallon.

3. In Dixon, Ky., the tank-wagon ceiling for gasoline is increased 1.5 cents a gallon for both premium and regular grades.

4. A uniform maximum price of $1.35 per barrel is established for distillate diesel oil of lower than 28° gravity when sold at Gulf Coast ports and in the New Orleans area. The ceiling for distillate diesel oil of 28° gravity and above remains at $1.65. An increase of 10 cents a barrel is allowed on any of these products sold at Gulf Coast ports and in the New Orleans area when single-lot deliveries are made in quantities of 20 bbl. or less.

5. Dollar-and-cent ceilings are established on sales of kerosene, distillate fuel oils, gas oils and gasoline, f.o.b. refineries at lower inland Texas points, which are designated in a list of the counties covered.

6. Quotations for gas oils on the Gulf Coast and for gasoline at New York Harbor, published in the October 8, 1941, issue of National Petroleum News, cannot be used as the ceilings at the points designated. Specific ceilings already have been provided for gas oils on the Gulf Coast, and ceilings for gasoline at New York Harbor should be determined on the basis of prices charged on actual sales made to the same class of purchaser during the base period, which was 60 days preceding October 15, 1941.

The changes constitute Amendment 12 to Maximum Price Regulation 88—fuel oil, gasoline and liquefied petroleum gas.

Ship Deliveries for June Include 20 Tankers

WASHINGTON.—Of 145 ships delivered in June, U. S. Maritime Commission reports that 20 were standard tankers. This compares with 21 deliveries in May and 17 in April. Sun Shipbuilding & Dry Dock Co., Chester, Pa., topped the list of tankers delivered, with six to its credit. June shipyard completions aggregated 1,379,994 deadweight tons, bringing the year's total to 864 vessels of 8,627,551 deadweight tons.

DEATHS

Henry Langspecht, 52, former chief scout of Shell Oil Co., Inc., and since 1937 independent operator and lease broker, died July 23 in Tulsa. After graduation from Amherst College, Langspecht went to Oklahoma and in 1917 joined Roxana Petroleum Corp., later Shell Oil Co. He rose to the position of chief scout, which he held for a long time prior to his resignation in 1937 to enter business for himself. He was one of the founders of University Club in Tulsa and was a member of Phi Psi fraternity.

Lawrence L. Carroll, 62, for years a drilling contractor in Oklahoma and Texas, died July 20 in Vancouver, Wash. He was a partner of C. A. Steinberger in the firm of Steinberger & Carroll, Tulsa, until 1923, when he sold his interest to Steinberger. After that he operated individually. He moved to Vancouver in 1943.

Edmund H. Lunken, 83, chairman of the board of The Lunkenheimer Co., Cincinnati, valve manufacturers, died July 19 at his summer home in Michigan. In 1929 Lunken purchased 204 acres of land in the Little Miami River Valley and donated it to Cincinnati for airport purposes. Around this nucleus the present Lunken Airport was built.

A. A. Brown, 54, vice president in charge of sales for Oklahoma Gas & Electric Co., died July 18 in Oklahoma City. He joined that company in 1921. He served overseas in World War I.

Truett B. Cranfill, 49, one of the discoverers of the Sand Hills oil field in West Texas, died July 17 in Dallas. He was president of Southwest Oil Production Co. and Dixie Royalty Oil Co. and a partner in Cranfill Brothers Oil Co.

James Roscoe Smith, 57, who had oil-producing properties in Mississippi and East Texas, died July 7 in Dallas.

DRILLING FORECAST

Sharp Increase Indicated

by H. Stanley Norman

THE petroleum industry proposes to drill 14,985 development and exploratory wells in the second half of this year, the highest rate ever programmed and previously exceeded only by the first 6 months of 1937 when 15,122 completions were registered. The program calls for drilling 52,779,673 ft. of hole, 44 per cent more than was recorded during the first half of this year.

These pertinent yardsticks for the months immediately ahead were disclosed this week in a composite summary of the Journal's drilling survey. The results confirm and amplify expressions of concern by members of the Petroleum Industry War Council at Washington last week concerning the outlook for materials upon which the industry is dependent for fulfilling its war-supply obligations.

Practically all companies contributing to the composite data asserted that the drilling program is dependent on prompt receipts of materials, particularly of the critical items. The fact, however, that the drilling end of the industry is gearing its operations for the completion of 576 wells per week during the second half is a significant milepost in prosecution of the war assignment. The industry, through its drilling commitments, asserts that the locations are available and that it needs only materials and manpower to meet the higher demands which still are rising.

There is a strong possibility that several areas will receive more completed wells than indicated in the accompanying table because some of the estimates were compiled before the stripper-well subsidy was definitely confirmed. Drilling influenced by the subsidy would be concentrated in the eastern area and increases above earlier schedules would consist largely of service wells. Many companies operating in Pennsylvania, New York and West Virginia already have increased their drilling programs and a few will drill 100 per cent more wells in the second half than in the first 6 months, reflecting current emphasis on secondary-recovery projects.

Normal Increase

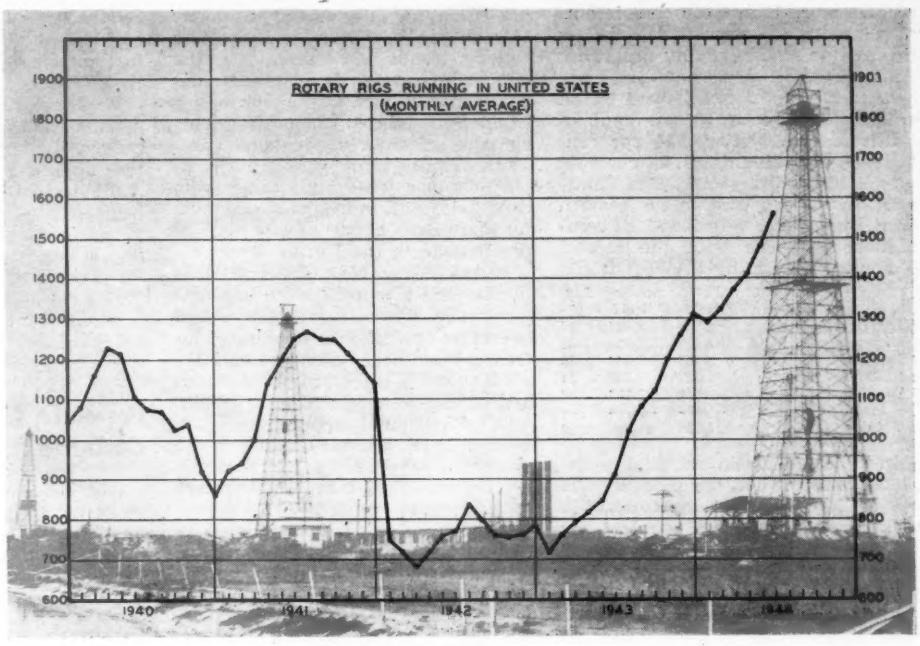
The increase of 32 per cent in the calculated number of completions during remainder of the year is partially absorbed by normal inclines in the drilling curve during the second 6 months. The customary increase in completions for the second half is approximately 20 per

Comparison of First-Half Drilling With Objectives for Last 6 Months

	First 6 months, 1944*				Projected operations, second 6 months, 1944				Footage	
	Total wells completed				Wells programmed					
	Rotary tools	Cable tools	Number of field wells	Number of wildcat wells	Rotary tools	Cable tools	Number of field wells	Number of wildcat wells	First 6 months 1944	Second 6 months 1944 (programmed)
Alabama	14	....	6	8	15	2	3	14	68,055	82,600
Arizona	....	1	....	1	1	1	....	2	3,607	6,500
Arkansas	98	6	73	31	105	5	92	18	577,600	616,000
California	970	....	864	106	1,300	....	1,145	155	3,515,280	4,810,000
Colorado	10	3	7	6	11	3	10	4	66,990	76,600
Florida	2	....	....	2	8	....	2	6	17,050	71,000
Georgia	....	1	....	1	4	....	....	4	4,110	24,000
Illinois	801	20	661	160	885	25	750	160	2,005,700	2,568,850
Indiana	119	9	116	12	147	23	156	14	249,600	340,000
Iowa	....	....	....	....	....	1	....	1	.....	3,500
Kansas	789	108	653	244	808	110	688	230	3,006,700	3,121,200
Kentucky	152	228	345	35	166	232	358	40	755,400	796,000
Louisiana	362	2	295	69	533	3	436	100	2,604,800	3,827,600
North Louisiana	136	2	109	29	209	3	170	42	593,400	911,600
South Louisiana	226	....	186	40	324	....	266	58	2,011,400	2,916,000
Maryland	....	....	....	....	1	....	....	1	.....	10,000
Michigan	222	56	172	106	292	32	227	97	701,670	842,400
Mississippi	46	2	20	28	150	....	105	45	270,480	855,000
Missouri	2	....	2	....	4	....	2	2	2,800	5,200
Montana	160	2	146	16	192	2	175	19	403,704	485,000
Nebraska	3	....	1	2	6	....	....	6	6,516	30,000
New Mexico	144	70	175	39	148	73	177	44	651,844	672,900
New York	....	632	630	2	....	758	753	5	881,640	1,360,610
Ohio	....	456	429	27	2	705	660	47	1,227,550	1,914,300
Oklahoma	680	120	635	165	950	235	960	225	2,855,200	4,229,265
Oregon	1	....	....	1	....	....	....	....	6,940	.....
Pennsylvania	30	1,240	1,219	51	40	1,992	1,951	81	2,590,100	3,942,100
Tennessee	1	6	3	4	2	6	3	5	6,145	7,300
Texas	2,422	376	2,092	706	3,722	476	3,093	1,105	12,811,590	19,788,640
East Texas	143	....	70	73	269	....	160	109	840,697	1,506,938
North Texas	548	118	495	171	674	138	601	211	1,784,880	2,192,400
South Texas	52	2	34	20	70	....	35	35	178,740	231,700
Lower Gulf Coast	437	....	306	131	659	....	461	198	3,167,376	4,787,777
South Central Texas	211	3	111	103	343	2	208	137	882,108	1,422,090
Upper Gulf Coast	226	....	161	65	377	....	264	113	1,637,370	2,739,659
Panhandle	89	8	94	3	133	14	136	11	307,102	467,313
West Texas	657	125	678	104	1,097	122	976	243	3,575,304	5,701,263
West Central Texas	59	120	143	36	100	200	252	48	438,013	739,500
Utah	....	....	....	....	3	2	....	5	.....	20,000
West Virginia	....	457	439	18	....	685	650	35	1,169,463	1,752,913
Wyoming	89	3	72	20	113	6	79	40	415,288	510,195
Total	7,117	3,798	9,055	1,860	9,608	5,377	12,475	2,510	36,875,822	52,779,673

*Excludes 441 service wells which are not allocatable from preliminary information.

Rotary rigs in operation have shown a consistent increase during the year and even higher activity is anticipated, pushing the curve up to the 1,700 or 1,750 level



cent, indicating that the industry program for remainder of the year is 1,358 wells above normal expectancy.

The increase of 108 per cent forecast in second-half completions in Mississippi probably is the outstanding feature in the District 3 outlook although the projected total of 150 wells is unimpressive compared with Texas. An increase of 60 per cent anticipated by Texas operators will boost completions in that state to 4,198 for the second half. The Texas increases are fairly well distributed from a percentage standpoint with emphasis on West Texas because of its latent productive capacity and on the Gulf Coast because of its proximity to war-product refining facilities.

Details of the drilling forecast show that practically all the increases above normal completion expectancy will be concentrated in the Southwest and California. The six oil states in Petroleum Administration for War's District 3, Alabama, Mississippi, Arkansas, Louisiana, New Mexico and Texas, will

How the Drilling End of the Industry Performed a Year Ago

	First 6 months 1943				Second 6 months, 1943				Footage	
	Total wells completed				Total wells completed					
	Rotary tools	Cable tools	Number of field wells	Number of wildcat wells	Rotary tools	Cable tools	Number of field wells	Number of wildcat wells	First 6 months 1943	Second 6 months 1943
Alabama	1	....	....	1	6	2	....	8	1,856	29,064
Arizona	....	1	....	1	3	1	....	4	2,750	11,500
Arkansas	110	9	104	15	114	20	120	14	590,597	603,938
California	658	....	592	66	789	....	710	79	2,148,400	2,644,100
Colorado	4	2	4	2	20	4	19	5	17,670	64,800
Florida	3	1	....	4	3	2	....	5	26,800	33,500
Georgia	1	....	....	1	1	....	....	1	6,500	4,200
Illinois	790	28	610	208	895	38	746	187	1,963,200	2,332,500
Indiana	93	14	86	21	112	28	111	29	179,650	245,000
Iowa	1	....	....	1	1	....	....	1	1,200	1,500
Kansas	638	130	615	153	929	38	697	270	2,598,900	3,239,450
Kentucky	104	156	208	52	159	237	317	79	614,640	792,000
Louisiana	319	2	255	66	348	4	278	74	2,222,994	2,303,850
North Louisiana	149	2	136	15	158	4	145	17	643,864	648,000
South Louisiana	170	....	119	51	190	....	133	57	1,579,130	1,655,850
Michigan	173	73	172	74	229	153	268	114	486,342	955,000
Mississippi	40	1	33	8	73	1	52	22	230,000	408,110
Missouri	5	....	1	4	18	2	6	14	5,100	22,300
Montana	96	2	86	12	141	1	121	21	208,936	315,380
Nebraska	9	....	2	7	27	3	7	23	28,000	97,581
New Mexico	70	35	84	21	96	50	128	18	300,930	450,850
New York	....	570	568	2	....	677	673	4	940,500	1,184,750
Ohio	....	401	381	20	....	578	543	35	1,036,585	1,473,900
Oklahoma	428	107	372	163	519	130	446	203	1,812,185	2,132,660
Pennsylvania	36	1,189	1,176	49	25	1,285	1,258	52	2,454,900	1,985,610
Tennessee	....	5	2	3	....	3	1	2	4,350	2,690
Texas	1,816	225	1,542	499	2,403	302	1,999	706	8,836,705	11,456,459
East Texas	142	....	77	65	168	....	70	98	683,730	958,608
North Texas	505	89	464	130	862	95	728	229	1,643,598	2,527,437
South Texas	34	1	21	14	36	2	26	12	106,750	116,090
Lower Gulf Coast	282	....	226	56	357	....	286	71	2,038,860	2,581,110
South Central Texas	176	2	107	71	191	2	106	87	756,500	824,118
Upper Gulf Coast	155	....	101	54	187	....	113	74	1,124,213	1,356,311
Panhandle	98	7	99	6	93	2	90	5	291,690	261,254
West Texas	361	40	340	61	439	51	419	71	1,827,357	2,288,790
West Central Texas	63	86	107	42	70	150	161	59	364,007	542,741
Virginia	....	....	....	....	....	1	....	1	.....	1,700
West Virginia	....	293	279	14	....	432	411	21	741,876	1,093,824
Wyomng	57	4	46	15	68	4	58	14	252,235	301,608
Total	5,452	3,248	7,218	1,482	6,979	3,996	8,969	2,006	27,713,801	34,187,824

receive more than 5,000 completions if operators are permitted to follow through on their existing programs. An increase of approximately 55 per cent in District 3 is followed by an anticipated rise of 33 per cent in California completions, 24 per cent in the Rocky Mountains, 22 per cent in the Middle West and Mid-Continent and 17 per cent in the eastern area. Here is the way first-half completions compare with the second 6-month program by PAW districts:

	First half	Second half	Inc. %
1 District 1	2,984	3,487	17
2 District 2	3,770	4,632	22
3 District 3	3,363	5,232	55
4 District 4	267	332	24
5 District 5	972	1,302	33
Total	11,356	14,985	32

In order to attain the high completion total which the industry has set as its goal an average of 576 wells per week will be required for the last 6 months. Last week's completions rose to 453 but this means that there must be several weeks during the next 5 months in which more than 600 wells are finished, in order to make up for deficits which are already incurred.

Previous Peak Surpassed

The number of rotary rigs currently in operation surpasses the previous peak for this type of drilling in 1941 by approximately 250 units. Oil companies and independents propose to drill 9,608 rotary wells which will account for 63 per cent of the completions. The new hole expected from rotary drilling will probably fall at about 40,000,000 ft., allowing for the almost exclusive use of this type of rig in the deeper areas. The daily rate of rotary completions must be 52 in order to achieve the industry's objectives, leaving an average of 30 wells daily to be completed by cable tools.

The monthly index of completions to active rotary rigs in operation is about 1.5 to 1, indicating that there should be 1,700 to 1,750 active rotaries to complete nearly 15,000 wells in 6 months. In other words, PAW and the War Production Board have the obligation to free 50 to 75 additional rotary rigs with complements of drill pipe, engines, pumps, tool joints, truck transportation and the other essential operating equipment.

Certain details are hazardous in forecasting drilling operations for a period of 6 months or longer because of the essential flexibility in company programs to allow for contingencies. New discoveries in areas originally scheduled for moderate exploration activity, for example, are certain to distort previous calculations, particularly in the war emergency period when there are no idle rigs to absorb the shock of increased drilling obligations.

While apparently on the optimistic side, the drilling program accurately reflects trends and thinking in the exploratory and development departments of virtually every major company and a substantial percentage of the independent operators. Replies upon which the composite tables were built came from companies and individuals who customarily drill about 80 per cent of the footage in the United States.

About 16 per cent of completions in the first 6 months were exploratory wells. The survey indicates that operators propose a moderate increase in wildcat drilling. The 2,510 wildcat wells projected for remainder of the year are nearly 17 per cent of the total drilling program. Several areas are outstanding in the exploratory program. Mississippi, for instance, is expected to receive 45 exploratory wells out of 150 programmed for the last 6 months, or 30 per cent of the total. West Texas, too, is above the national average with 243 exploratory wells expected to be drilled, about 20 per cent of the total programmed for the district.

Ohio Oil Starting Deep Maryland Test

SALISBURY, Md.—The first drilling test launched as a follow up on the extensive East Coast leasing program which has been under way for the past 10 months was announced last week by Ohio Oil Co., Findlay, Ohio. The company announced that it would start drilling operations within the next 2 weeks in Wicomico County, Maryland. Location has been made on the 100-acre Larry G. Hammond farm, 6 miles east of Salisbury on the Mount Hermon road.

Ohio Oil Co. has approximately 250,000 acres under lease in Wicomico and adjacent Worcester counties and has a smaller concentration of acreage in lower Delaware.

Leasing operations continue active at various points along the Atlantic seaboard. Carter Oil Co. and Sinclair Prairie Oil Co. recently completed negotiations for 168,000 and 164,000 acres, respectively, in North Carolina.

Exploration work preceding selection of location for Ohio Oil Co.'s Maryland wildcat test was conducted by General Geophysical Co., Houston, which operated a crew in this vicinity for 6 months. Geophysical work in the lower part of Delaware is reported under way for account of Pure Oil Co.

Stanley B. White, geologist for the Ohio company, supervisor of the geophysical and geological surveys, is remaining in Maryland. Byron Finch, in charge of the land and leasing operations, has returned to Findlay and will be replaced by R. L. Fillner from the home office.

William Wentworth, drilling superintendent for Ohio Oil, will be in charge of the wildcat operation. Before announcement of its start was made last week, the location was inspected by R. A. Koenig, Ohio division manager, and Fred Smith, production superintendent, both of Findlay.

The rig assigned to the Maryland location, company officials reported, is capable of drilling to 15,000 ft.

Pressure Maintenance Is Ordered for Lake Creek

AUSTIN. — An order issued last week by the Texas Railroad Commission requires that reservoir pressures in three sands of the Lake Creek field, Montgomery County, be maintained at a point high enough to insure maximum recovery of hydrocarbons that assume a liquid state when pressure drops too low. The order was characterized by Beauford Jester, chairman of the commission, and Col. Ernest Thompson, a member, as a major step in gas conservation.

Olin Culberson, third member of the commission, agreed with the purpose of the order but declined to sign it because he doubted the commission's statutory authority "to take this constructive and forward step which looks to the utilization of the greatest possible volume of component elements recoverable from natural gas."

The commission held hearings last March on Superior's application for the new order.

Geophysical Work Is Centered in Southeast

WASHINGTON. — Twenty-five per cent of the active geophysical crews in the country are concentrated in the southeastern states of Mississippi, Alabama, Florida and Georgia. This report, indicating significant trends in exploratory drilling operations during the remainder of this year and carrying through 1945 and later, was disclosed at last week's meeting of the Petroleum Industry War Council.

During May, the Petroleum Administration for War production division reported to PIWC, 467 geophysical and core-drill units were active in the United States. This is an increase of 31 crews over April. Crews active during May were: Seismograph, 295; gravity meter, 114; magnetometer, 13; core drill, 44, and torsion balance 1.

Well Completions Increase 30 Per Cent First Half of 1944

by Charles J. Deegan

REFLECTING increased transportation outlets, modified restrictions on well spacing and the rising tempo of military demands for petroleum products, total completions in the first half of 1944, including input wells, were 11,356, or an increase of 30.2 per cent over the same period in 1943. The eastern area of New York, Pennsylvania, Ohio and West Virginia accounted for 3,437 of the completions, or about 30 per cent, and 1,822 of these were in the Allegany-Bradford secondary-recovery area.

Among the major oil-producing states, Texas set the pace with 2,619 completions, followed in order by California with 970, Kansas 897, Illinois 821 and Oklahoma 800. No other major oil state completed as many as 400 wells. The nine major producing states (see Table 3) which as of July 1, 1944, were accounting for 95 per cent of the domestic output, had an increase in completions of 31.4 per cent over the first half of 1943, while the eastern area of New York, Pennsylvania, West Virginia and Ohio increased completions 26.8 per cent and all the remaining states increased completions 34.1 per cent. Thus, the national average increase of 30.2 per cent was well distributed.

Wildcatting activity was probably at an all-time high, the total wildcat completions being 1,745 in the first 6 months of 1944, or 15.8 per cent higher than in the first half of 1943.

Analysis of the completions in 1944 shows that in the nine major producing states oil-well completions increased 45 per cent, gas-well completions rose 34.3 per cent, while dry holes were up only 12.2 per cent. This is the result of concentration on drilling in proven areas to increase production fast enough to meet the war requirements.

Exploratory drilling along the entire Gulf coastal region from the Mississippi state line through southern Louisiana, Texas Gulf Coast and Southwest Texas, has maintained a pace during the first half of 1944 about 19.5 per cent higher than for the same period in 1943, yet the discovery ratio has shown a slight decrease.

During the first half of 1943, throughout the coastal area, wildcatters opened production of some kind with one out of every five wildcats drilled. So far this year only one out of every seven has produced. In the Southwest Texas and lower Gulf Coast area, wildcatting fell off in the former and although increasing in the latter, there were fewer successes. Including South Central Texas, this area accounted for 18 new oil fields and 16 new gas or condensate fields in the first half of 1944. Upper Gulf Coast operators, on the other hand, drilled twice as many wildcats and found twice as many new fields as in the comparable period of 1943.

Six Discoveries in Louisiana

Southern Louisiana, which accounted for 13 new fields in the first half of 1943, has had only six discoveries in 1944 to date. On the basis of the discovery well's showing, perhaps the most important of

TABLE 1—WILDCAT COMPLETIONS FIRST 6 MONTHS, 1944

	Oil	Gas	Dry	Total
Ohio	0	10	32	42
Indiana	3	0	11	14
Illinois	11	0	149	160
Kentucky	5	0	30	35
Michigan	5	1	100	106
Kansas	29	5	210	244
Nebraska*	1	0	2	3
Oklahoma	24	16	125	165
Texas:				
Gulf Coast	30	10	101	141
Southwest	19	11	126	156
West	14	3	87	104
Panhandle	0	0	3	3
North Central	30	1	140	171
Eastern	3	0	70	73
Total Texas	96	25	527	648
Louisiana:				
Northern	3	0	26	29
Southern	9	0	31	40
Total La.	12	0	57	69
Arkansas	3	0	28	31
Mississippi	3	0	25	28
Alabama	1	0	7	8
Georgia	0	0	1	1
Florida	1	0	1	2
Montana	2	1	13	16
Wyoming	11	1	8	20
Colorado	3	0	3	6
New Mexico	3	1	35	39
California	3	4	99	106
Arizona-Oregon	0	0	2	2
Total U. S.	216	64	1,465	1,745
First half 1943	193	31	1,283	1,507

*Includes Missouri and Iowa.

TABLE 2—DEVELOPMENT WELLS COMPLETED BY STATES FIRST 6 MONTHS, 1944

	Oil	Gas	Dry	Total
Eastern	*2,022	760	199	2,981
Ohio	62	207	145	414
Indiana	63	6	47	116
Illinois	499	3	159	661
Kentucky	149	97	99	345
Michigan	92	22	58	172
Kansas	394	23	236	653
Nebraska†	2	2	1	5
Oklahoma	402	58	175	635
Texas:				
Gulf Coast	356	48	118	522
Southwest	78	6	28	112
West	629	2	47	678
Panhandle	79	1	14	94
North Central	351	3	141	495
Eastern	52	7	11	70
Total Texas	1,545	67	359	1,971
Louisiana:				
Northern	55	13	41	109
Southern	137	5	44	186
Total La.	192	18	85	295
Arkansas	57	1	15	73
Mississippi	15	0	5	20
Alabama	3	0	3	6
Montana	107	10	29	146
Wyoming	68	0	4	72
Colorado	5	0	2	7
New Mexico	136	8	31	175
California	792	13	59	864
Total U. S.	6,605	1,295	1,711	9,611

*Includes input wells.
†Includes Missouri and Iowa.

TABLE 3—COMPARISON OF DRILLING RESULTS, 6 MONTHS 1944 VS. 1943

	6-mo. total completions 1944	6-mo. total completions 1943	Per cent change 1944	Thou. bbl. oil prod. 7-1-44 dly. av.	Oil-well completions 1944	Oil-well completions 1943	Per cent change 1944	Gas-well completions 1944	Gas-well completions 1943	Per cent change 1944	Dry-hole completions 1944	Dry-hole completions 1943	Per cent change 1944
Texas	2,619	1,856	+41.4	2,036	1,641	965	+70.1	92	70	+31.4	886	821	+7.9
California	970	658	+47.4	850	795	525	+51.4	17	14	+21.4	158	119	+32.8
Louisiana	364	321	+13.4	362	204	153	+33.3	18	24	—25.0	142	144	—1.4
Oklahoma	800	535	+49.5	338	426	242	+76.0	74	45	+64.4	300	248	+21.0
Kansas	897	768	+16.8	275	423	393	+7.6	28	9	+211.1	446	366	+21.9
Illinois	821	818	+0.4	209	510	485	+5.1	3	10	—70.0	308	323	—4.6
New Mexico	214	105	+103.8	108	139	74	+87.8	9	6	+50.0	66	25	+164.0
Wyoming	82	55	+67.3	94	79	42	+88.1	1	1	....	12	12	....
Arkansas	104	118	—12.6	80	60	70	—14.3	1	2	—50.0	43	47	—8.5
Nine-state subtotal	6,881	5,235	+31.4	4,352	4,277	2,949	+45.0	243	181	+34.3	2,361	2,105	+12.2
Eastern, including Ohio	3,437	2,710	+26.8	67	2,084	1,954	+6.6	977	526	+85.7	376	230	+63.5
All other states	1,038	774	+34.1	164	560	317	+76.6	139	119	+16.8	439	338	+29.9
Total United States	11,356	8,719	+30.2	4,583	6,821	5,220	+30.7	1,359	826	+64.5	3,176	2,673	+18.8

the southern Louisiana fields will be Sun Oil Co.'s Cankton field.

The campaign on the eastern flank of the coastal productive area in Mississippi is still in the early stages both of exploration and development. The development at the Heidelberg field is picking up momentum and considerably more will be known as to its caliber by the end of 1944. The Eucutta field will see a fairly substantial development campaign in the last half of 1944.

West Texas, with increased transportation outlets, experienced substantial increases in development. There were 104 wildcats completed in the first half of 1944, 14 of which resulted in oil discoveries, although at this time only a few seem likely to be important. Probably the most important discovery of the year to date is the North Monahans pool in southern Winkler County, producing from the Tubb pay of the Clear Fork.

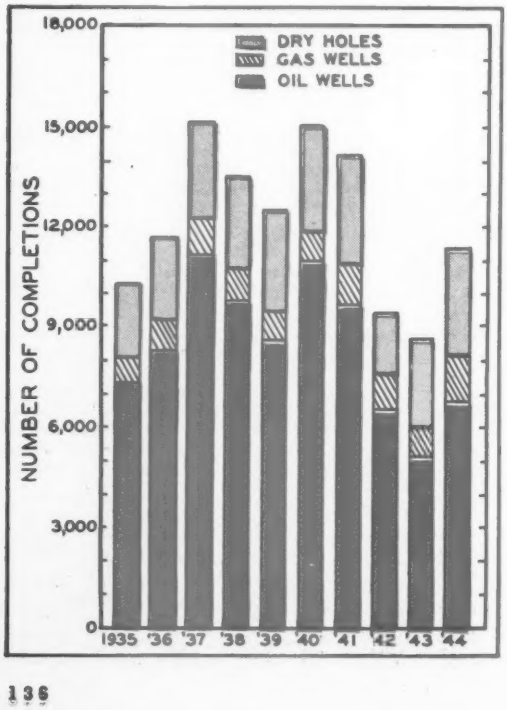
A new San Andres lime pool was opened in Hockley County. Although the well produced only 61 bbl. of oil with 19 bbl. of water, there was mechanical trouble in completion and the discovery may be important. In the same county, Woodley Petroleum Co. opened the Smyer pool, producing from the Clear Fork.

In New Mexico there have been two discoveries in Lea County this year, the most important of which appears to be a 600-bbl. per day well from the San Andres lime, in 4-17s-36e, between the South Lovington and the Vacuum pools. The other was a Texas Co. discovery in 22-19s-33e, between the Northwest Lea and the East Lusk pools, which flowed 290 bbl. daily from a sand formation in the upper Permian.

SUMMARY OF COMPLETED WELLS
First Six Months in 1944

	Oil	Gas	Dry	Total	Average footage	Total Jan.-June 1943
Eastern	*2,022	760	199	*2,981	1,429	*2,309
Ohio	62	217	177	456	2,692	401
Indiana	66	6	58	130	1,920	107
Kentucky	154	97	129	380	1,988	260
Michigan	97	23	158	278	2,524	246
Illinois	510	3	308	821	2,443	818
Mississippi	18	0	30	48	5,635	41
Alabama	4	0	10	14	4,861	1
Florida	1	0	1	2	8,515	0
Georgia	0	0	1	1	4,110	0
Kansas	423	28	446	897	3,352	768
Nebraska	2	0	1	3	2,172	9
Missouri-Iowa	1	2	2	5	957	5
Oklahoma	426	74	300	800	3,569	535
Texas	1,641	92	886	2,619	4,651	1,856
North Central	381	4	281	666	2,680	594
Eastern	55	7	81	143	5,879	142
West	643	5	134	782	4,572	401
Panhandle	79	1	17	97	3,166	105
Southwest	97	17	154	268	4,310	226
Gulf Coast	386	58	219	663	6,745	388
Louisiana	204	18	142	364	7,209	321
Northern	58	13	67	138	4,296	151
Southern	146	5	75	226	8,988	170
Arkansas	60	1	43	104	5,553	119
Montana	109	11	42	162	2,492	98
Wyoming	79	1	12	92	4,514	55
Colorado	8	0	5	13	5,153	7
New Mexico	139	9	66	214	3,046	105
Arizona	0	0	1	1	3,607	0
Oregon	0	0	1	1	6,940	0
California	795	17	158	970	3,624	658
Total 1944	*6,821	1,359	3,176	*11,356	3,386	*8,719
Total 1943	*5,220	826	2,673	*8,719	3,047	.....
Difference	*2,501	533	503	*3,537	339	.....
Total 1942	*6,639	997	2,769	*10,405	.....	.....
Total 1941	*9,724	1,251	3,278	*14,253	.....	.....
Total 1940	*11,000	920	3,117	*15,037	.....	.....
Total 1939	*8,609	866	2,992	*12,467	.....	.....

*Includes input wells in eastern fields.



The Panhandle of Texas had a quiet 6-month period with no wildcat strikes. In West Central Texas five new pools were opened, but the only one that appears at this time to be noteworthy is a Strawn pool in Coleman County, 1 mile south of Novice, where a poor discovery well has been followed by four wells, each good for 450 bbl. daily or better.

In North Central Texas, the Hildreth pool in Montague County added 33 oil wells out of 36 completions from the Bend comglomerate and Simpson pays, and now covers more than 3,000 acres, with further extensions probable. In Cooke County the Woodbine sand pool opened by Northern Ordnance, Inc., appears to be disappointing, as is also the Montgomery pool discovered in January by Sinclair Prairie Oil Co. The Wynn pool of eastern Clay County has had four good completions from the Mississippi lime. There were two Mississippi lime pools discovered and one new Strawn pool in Clay County during the first half of 1944. Young County claimed eight discoveries, of which the Kerlyn Oil Co. Caddo lime well, 4 miles west and north of the Garvey pool, appears to be the most important, having flowed 614 bbl. per day.

East Texas Stimulated

Eastern Texas was about to write the first half year off as a disappointment until the Phillips Petroleum Co. 1 McMinn, M. Long Survey, south of Tyler, started flowing 40-gravity oil from the Coquina lime of the lower Glen Rose at 9,865-9,960 ft., with the Pettit and Travis Peak formations yet to be tested.

In California wildcat explorations resulted in the discovery of four new oil fields, a new lower oil zone at Buena Vista Hills and four new gas fields. The development program for the Elk Hills Naval Reserve calls for completion of about one well per day beginning about August 15 and continuing through the end of the year. Rapid develop-

(Continued on page 142)

Production Increases 100,742,000 Bbl.

Demand Forces Second-Half Forecast Upward

by Charles J. Deegan

CRUDE-OIL production records for the first half of 1944 show an increase for the United States of 100,742,000 bbl. over the same period in 1943, and an examination of the sources of the total supply and the increases discloses that the United States is fueling the war from oil stocks or reserves that were mostly proven when the fighting started.

Of the 100,742,000 bbl. increase, Texas accounted for the lion's share by contributing 94,373,000 bbl., followed by California with an increase of 11,293,000 bbl. The combined net for the remaining states was a loss of 5,924,000 bbl., gains in Louisiana and New Mexico being more than offset by losses in Kansas, Mississippi, Illinois and Oklahoma.

Despite this increase, which amounted to 14.19 per cent over the first half of 1943, stocks of crude oil have shown a fairly steady decrease since January 1. In the past few weeks, with crude production at all-time highs, stocks of crude oil have been declining at a more rapid rate than during the first 5 months of the year. All evidence seems to confirm the fact that the military forecasts of their petroleum requirements have been consistently low. During the last half of 1944, barring a sudden end to the European phase of the war, the industry will be called upon to increase crude production substantially above current all-time record levels.

Records of the past 6 months and the current rates indicate that substantial increases in production within such a short period as 6 months can come only from Texas and California. There are numerous other areas which show much promise for the future, but these are long term developments. Mississippi is obviously headed for a relatively heavy development campaign and a substantial increase in production, but as of the middle of this year, the newer developments had just about reached the point where they overcame the normal decline in Tinsley and Pickens. Next year may see substantial increases in Mississippi production, but for the last half of 1944 it will be a minor factor.

The situation in Wyoming is substantially the same as in Mississippi, bright future prospects, but nothing significant to count on in the last half of 1944. The same thing holds true of Oklahoma, currently showing signs of a great comeback as an oil-producing state, which may well put it back in third place in 1945 above Louisiana which forged ahead in 1943. But Oklahoma's future oil lies in deep fields and shortages of material and manpower will not permit sufficiently rapid development to increase production by any large amount in the last half of 1944.

Louisiana Holds Its Own

Louisiana, now the third ranking state, has held its own so far in 1944, with moderate increases in the southern fields being offset by declines in the northern areas. Developments in the last half of 1944 may bring some small increases, but currently there seems little likelihood of any large production increases within the last half of the year.

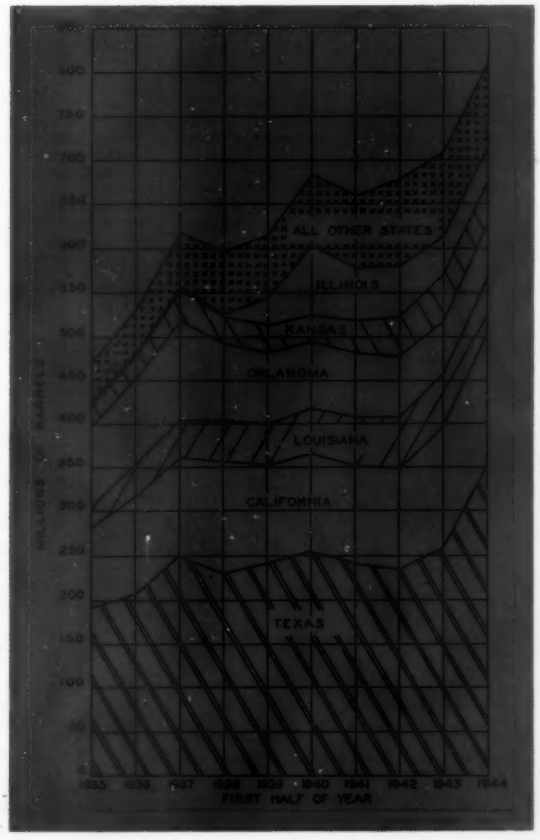
Kansas, the fifth ranking state, is now producing slightly less oil than a year ago, and total production for the first half of 1944 was about 10 per cent less than the same period of 1943. It appears now that the current rate of development is not sufficient to maintain the potential "shutin" production with which Kansas started this war. After drawing on that potential to its maximum efficient rate, which accounted for the increases in the latter part of 1942 and in 1943, total production has fallen, and current drilling seems unable to sustain it. Further slight declines are probable during the last half of 1944.

Illinois, the sixth ranking state, has finally checked the precipitous decline in production of the past 3 years. With a slower rate of natural decline in the older wells, and further relaxation of drilling restrictions, production for the last half of 1944 will probably hold its own and may increase slightly.

New Mexico has always been hampered by the same economic and transportation factors as prevail in West Texas, plus the additional fact that it was at the extreme end of the same pipe line outlets serving both areas. Production in the first half of 1944 was about the same as the last half of 1943.

Arkansas, due to wise conservation practices, continues to maintain a steady pace of production. Present rates of development indicate a continuation of current production rates through the last half of 1944.

Charted relationship of the six major producing states compared to all other domestic oil fields



Michigan is the only state, not previously discussed, that produces as much as 50,000 bbl. per day, and it is having a struggle to keep daily production slightly above that mark. There are one or two promising areas, but nothing in sight now that looks as though Michigan would do much more than hold its own for the remainder of 1944.

Considering the United States as a whole and deducting Texas and California production, the combined total daily average of all the other states was 1,688,000 bbl. for the first half of 1944, against 1,724,000 bbl. in the same period in 1943. As of July 1, 1944, their combined total was about 1,682,000 bbl. daily, or 6,000 bbl. under the 1944 half-year average, and 42,000 bbl. under the 1943 6-month average. On that basis, with due allowance for favorable indications in several places, and with some allowance for the effect of the subsidy on stripper production, an average of 1,690,000 bbl. per day over the last half of 1944 seems reasonably optimistic.

California is now hovering around the 850,000-bbl.-per-day mark and the present rate of development should enable all fields except Buena Vista Hills and Elk Hills to hold their own for the remainder of the year, allowing whatever increase is obtained from these two fields to be net gain for the state. Buena Vista Hills has prospects of increasing production by from 10,000 to 25,000 bbl. per day by the end of the year so that an average of 10,000 bbl. daily over the entire 6 months is possible. The assignment of 12 strings of tools to development of the Elk Hills naval reserve, with completions confined to the shallow zones at an average depth of 3,000 ft., means possibilities of adding another 25,000 bbl. to its current daily output of 15,000 bbl. Assuming it averages 30,000 bbl. for the entire last half year, this means an increase of 15,000 bbl. per day over the July 1 rate. The net result would be a California production averaging 875,000 bbl. per day over the last half of 1944, ending the year with about 900,000 bbl. daily production.

In Texas, the report of the District 3 subcommittee on reserves and development (see The Oil and Gas Journal, July 8, 1944, p. 36), indicates a sustained producibility for the last half of 1944 of 2,085,000 bbl. per day. This report, however, does not consider transportation or storage outlets, nor does it take into account types of crude required for the war effort. On the other hand no allowance, in total, was made for new wells to be drilled in the last half of 1944, and to that extent the producibility figure is distorted.

After making a study from independent sources, with allowances for new drilling, The Oil and Gas Journal's figures indicate, despite the fact that West Texas full potential production will not be available owing to lack of pipe-line outlets, total Texas production for the last half of 1944 will average 2,095,000 bbl. per day, with production at the end of the year about 2,140,000 bbl. daily. This of course is on the basis that the European war demands continue heavy during the entire last half.

The following table summarizes the results of the Journal's analysis on Texas:

(Daily average in thousand barrels)

	First half 1944	July 1, 1944	Second half 1944	Second half change*
Upper Gulf Coast	514	528	540	+26
Lower Gulf Coast	207	216	230	+23
South Texas	93	97	100	+7
West Texas	392	448	470	+78
Panhandle	91	92	91	...
N. & W. Central	144	149	154	+10
East Texas field	369	361	360	—9
East Central	125	145	150	+25
Total Texas	1,935	2,036	2,095	+160

*Estimated.

For the United States, the Journal estimates daily average production of 1,690,000 bbl. per day for all states combined except Texas and California, in the last 6 months Texas is expected to produce 2,095,000 bbl. daily and California 875,000 bbl., making a total for the entire country of 4,660,000 bbl. daily. Production at the end of the year will probably total about 4,730,000 bbl. per day. These figures are based on the assumption that all-out production will continue to be required for military purposes.

TEXAS PRODUCTION

	Six months 1944	Six months 1943	Difference
Upper Gulf Coast	93,594	61,800	32,794
Lower Gulf Coast	37,640	21,201	16,439
South	13,576	11,002	2,574
South Central	3,414	3,138	276
West	71,280	39,654	31,626
Panhandle	16,626	16,304	322
North and West Central	26,282	24,612	1,670
East Texas field	67,072	60,818	6,254
East Central	22,683	19,265	3,418
Total Texas	352,167	257,794	94,373

Production in United States 1939-43 and First Half, 1943-44

(In thousands of barrels)

	1939	1940	1941	1942	1943	First 6 months 1943	First 6 months 1944	Difference	Prod. wells 7-1-44	Dly. av. bbl. per well	Cumulative prod.
Arkansas	21,383	26,072	26,301	26,570	27,606	13,213	14,488	+1,275	3,106	25.6	621,787
California	225,493	223,104	230,317	247,132	284,286	139,842	151,135	+11,293	20,589	40.3	6,525,138
Colorado	1,415	1,412	1,734	2,309	2,431	1,156	1,420	+264	174	44.8	75,984
Illinois	92,203	146,484	128,550	106,590	77,637	41,538	39,231	—2,307	26,486	8.1	1,048,913
Indiana	1,711	4,978	6,536	6,609	5,343	2,711	2,613	—98	2,083	6.9	144,956
Kansas	60,973	64,832	81,899	96,879	105,697	54,479	49,786	—4,693	25,955	11.6	1,298,576
Kentucky	5,621	5,188	4,811	4,169	7,891	3,242	3,928	+686	14,335	1.5	153,873
Louisiana	94,182	103,410	117,634	128,231	125,780	61,260	64,492	+3,232	6,922	51.2	1,482,643
Michigan	23,563	19,733	16,325	21,748	20,535	10,526	9,286	—1,240	3,391	15.1	213,188
Mississippi	107	4,400	16,324	27,545	18,858	10,105	7,676	—2,429	384	109.8	75,336
Montana	5,853	6,583	7,344	8,045	7,641	3,744	4,316	+572	2,010	11.8	109,849
Nebraska	2	276	1,713	1,276	814	456	209	—247	60	19.1	4,463
New Mexico	37,872	39,488	38,586	31,914	38,924	18,283	20,235	+1,952	4,027	27.6	402,026
New York	5,098	4,999	5,126	4,988	4,313	2,281	1,844	—437	21,500	0.5	145,723
Ohio	3,156	3,159	3,284	3,563	3,185	1,560	1,465	—95	22,700	0.3	596,800
Oklahoma	152,400	149,629	153,167	137,792	120,559	60,965	59,987	—978	52,104	6.3	5,267,406
Pennsylvania	17,832	17,353	16,492	17,824	16,751	8,588	8,070	—518	82,000	0.5	1,055,222
Texas	482,335	489,183	501,348	477,828	589,129	257,794	352,167	+94,373	101,079	19.1	8,548,634
West Virginia	3,580	3,444	3,378	3,492	3,158	1,372	1,553	+181	16,680	0.5	425,116
Wyoming	21,207	26,232	30,009	32,736	34,766	16,628	16,583	+55	3,798	24.0	615,840
Miscellaneous	94	71	62	57	57	27	28	—1	173	0.9	1,299
Total	1,254,630	1,340,030	1,391,920	1,387,377	1,495,371	709,770	810,512	+100,742	409,556	10.9	28,812,772
Daily average	3,428	3,671	3,812	3,801	4,097	3,921	4,453	551	.....	....	.....

Record-Breaking Refinery Requirements Face Industry

by H. Stanley Norman

METAMORPHOSIS of the refining branch of the petroleum industry from a peacetime facility to a full-scale instrument of war was virtually completed at midyear. Processing of crude oil, pushed upward to five new peaks in the first 6 months, is expected to rise another 200,000 bbl. daily before the year ends. Preliminary figures for June indicate that crude-oil runs to stills of the domestic refining industry set an all-time peak of approximately 4,670,000 bbl. daily. Most observers expect the rate of operations to rise to 4,850,000 bbl. daily before the year is concluded.

Less than 40 war construction projects out of a grand total of 189 in the original 100-octane program remain to be completed at the end of July. Completion of the major war units will, of course, free manpower and materials for the vast backlog of maintenance and revamping projects which have been deferred from their normal sequence to give preference to the emergency program.

Current refinery operations are running approximately 20 per cent higher than at last midyear when the industry was completing the first wartime installations after Pearl Harbor. Future increases will be on a modified scale because of the sharp rise in operations during the last 6 months of 1943 as shown in Table 1.

Much of the near-future trend of refinery operations naturally depends on war developments. There is full accord among the industry's economists that a temporary slump in demand for petroleum products will immediately follow collapse of Germany or Japan. Many of the so-called behind-the-scenes reports from Washington show that the best military minds expect the European war to end in October or November. If these war-end predictions are confirmed by events, a modification of currently predicted refinery operations for the last 6 months would be in order.

Restrictions on civilian driving cannot be modified rapidly enough to compensate for cessation of military operations in Europe because the supply of rubber will not permit tire replacements for nonregulated travel. Conversion of tire manufacturing facilities, chiefly devoted currently to military requirements, will require more time than for adjustment of motor-fuel-distribution facilities.

Bulk of the increase in crude-oil runs to stills has been concentrated in eastern and Gulf Coast refineries, the so-called censored area where statistical data on operations are consolidated for military security. Since 1942, when eastern and coastal refineries reduced their operations to a meager average of 1,694,000 bbl. daily, the processing rate rose 34.4 per cent to a new peak of 2,277,000 bbl. daily during the first 6 months (see Table 2). The net increase of 583,000 bbl. in daily average operations was overshadowed percentagewise by California where the rate of crude-oil runs to stills advanced 40 per cent over the wartime low of 584,000 bbl. daily in 1941. Current refinery operations in California, which averaged 822,000 bbl. daily in June, will be pushed higher when it is possible to concentrate military pressure in the Pacific theater of war.

Full Capacity Utilized

Completion of the wartime transportation projects has been closely coordinated with the refinery-construction program and it became possible during the first half of 1944, for the first time since the United States entered the war, to make nearly maximum use of processing capacity. Of course, transportation and refining capacity are so closely related that one could not forge substantially ahead of the other without creating idle facilities.

Improvement in the overland movement of crude oil and petroleum products from the Southwest producing fields and refineries to the East Coast recently has made it possible to shift some of the railroad tank-car capacity to service between Texas and the Pacific Coast. Current reports from the Petroleum Administration for War indicate that tank-car movement of crude oil and special products from the Gulf Coast and other southwestern refining centers to California has been increased to around 80,000 bbl. daily. This rate of overland shipment to the Pacific Coast is in contrast to a previous rate of about 45,000 bbl. daily which started last fall in order to supplement the indigenous supply of crude in California.

Interior refineries, embracing the Mid-Continent, Middle West and Rocky Mountain districts, were holding their runs of crude oil at levels approximately the rate of operations at the start of the year (see Table 3). Declining production in the Middle West and Mid-Continent was only partially offset recently by completion of a pipe line from West Texas to Drumright, Okla., where previously existing lines and tank cars are utilized in completing distribution to individual plants. Installation of corrosion-resisting furnaces and fractionating towers will be necessary at numerous Mid-Continent and Middle West refineries before they are qualified to process the West Texas sour crude for extended periods.

Another contributing factor to the rising rate of refinery operations is the higher rate of foreign-oil imports. The May petroleum summary issued by the Bureau of Mines, the latest official figures available, show that United States refineries processed 3,756,000 bbl. of foreign crude, a daily average rate of 121,160 bbl. Runs of foreign crude at

TABLE 1—CRUDE-OIL RUNS TO STILLS
(Daily average, thousands of barrels)

	1941	1942	1943	1944
January	3,570	3,840	3,600	4,296
February	3,587	3,778	3,641	4,379
March	3,583	3,567	3,613	4,448
April	3,704	3,496	3,732	4,411
May	3,853	3,448	3,710	4,501
June	3,865	3,513	3,866	*4,670
July	3,909	3,599	3,893	....
August	4,018	3,682	4,094	....
September	4,049	3,782	4,203	....
October	4,089	3,757	4,162	....
November	4,051	3,746	4,218	....
December	4,032	3,656	4,260	....

*Preliminary.

TABLE 2—CRUDE-OIL RUNS BY DISTRICTS
(Daily average, thousands of barrels)

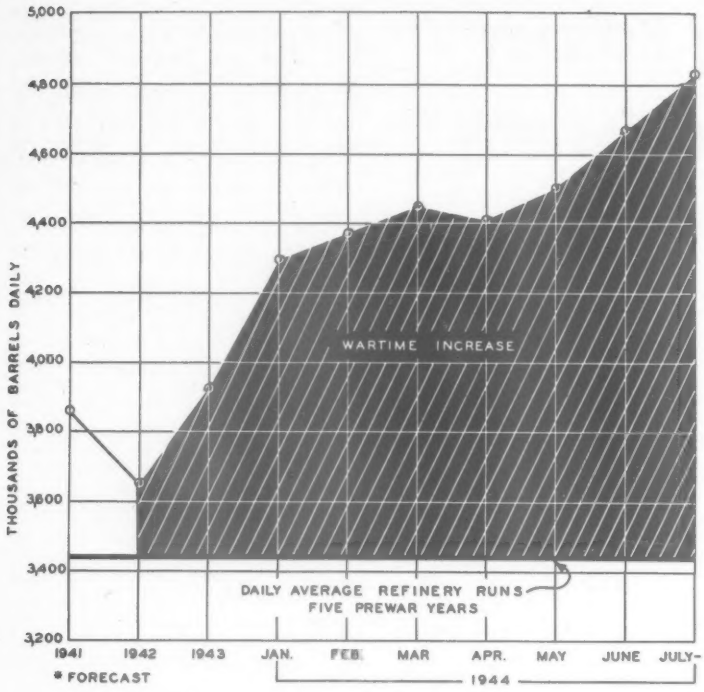
	Censored area	Interior	California
1941	2,002	1,257	584
1942	1,694	1,330	631
1943	1,879	1,322	723
1944 (6 mo.)*	2,277	1,346	822

*Preliminary.

TABLE 3—REFINERY OPERATIONS BY REGIONS, FIRST 6 MONTHS, 1944

	Censored area		Inland area		California	
	Dly. runs*	Per cent	Dly. runs*	Per cent	Dly. runs*	Per cent
January	2,126	49.4	1,381	32.1	789	18.3
February	2,206	50.3	1,364	31.1	809	18.5
March	2,294	51.5	1,365	30.7	789	17.7
April	2,286	51.8	1,317	29.9	808	18.3
May†	2,341	52.0	1,305	29.0	855	19.0
June†	2,428	52.0	1,354	29.0	887	19.0

*Thousands of barrels. †Preliminary.



How refinery runs have risen and where they are headed

domestic refineries that month were the highest since January 1942, and are in contrast to the wartime low of about 1,200 bbl. daily at the peak of tanker sinkings in the middle of 1942. Previously this year, the runs of foreign crude at United States refineries had averaged 91,100 bbl. daily. The increase of 33 per cent in foreign crude-oil receipts in May has tended to offset the western movement of a slightly higher volume to California.

Another significant point in the increase in receipts of foreign crude oil is that prospective future advances in domestic refinery operations will not necessarily require an equivalent rise in indigenous production. At best, however, tankers are available for transporting only a part of the increasing crude-oil requirements and domestic producers will be expected to sustain output at current or slightly elevated rates for remainder of 1944.

Postwar Plans Started

Possibly the most important development of the first half in the long-term outlook for refinery operations was the invitation from the Petroleum Administration for War for plant operators to submit their construction plans for immediate and postwar prosecution. There was no accompanying disclosure of bureaucratic plans for freeing the necessary materials. The inference was obvious, however, that with completion of remaining war projects a matter of months, PAW is preparing to recommend diversion of materials for the most urgent peacetime-plant construction in order to keep refining capacity at levels which would meet any contingency. Furthermore, there is an obligation on the part of PAW to assist refining companies which have been denied materials for one reason or another during the process of tooling up for war to regain a competitive position before the conflict ends, provided the equipment is available.

Approximately 450 refineries and natural-gasoline plants, including the 159 exclusively war projects, have been contributing directly or indirectly to the 100-octane program in the form of components. Most plants have made certain sacrifices either in volume or various special products in order to meet specifications of aviation gasoline.

Currently the demand is particularly urgent for additional volumes of butylene to make possible maximum production from alkylation plants. Like numerous other refining facilities built for production of war fuels, most alkylation plants are exceeding their guaranteed capacity. It is not uncommon for alkylation and catalytic cracking plants built as war facilities to produce at 150 to 175 per cent of their rated capacity. In addition to urgent requests from the military theaters for increased volume of aviation gasoline PAW, the industry's technical committees, and military authorities are anxious to make further improvements in quality. As soon as volume objectives are achieved, new-plant capacity and operating skill can be devoted to quality improvement, hence the emphasis on maximum operation of facilities to attain quantity as the primary industry assignment.

At the start of July, production of 100-octane gasoline had risen to more than 500,000 bbl. daily which is roughly 25 per cent of the total current demand for motor fuel. Ultimate 100-octane production goals surpass 600,000 bbl. daily and may be revised upward.

Light Fuels Emphasized

Currently, emphasis is placed on the production of distillate fuel oils in anticipation of another severe shortage of burning products on the East Coast next winter. Plant operators, however, are instructed to produce the maximum volume of distillate fuel without interferring in any way with manufacture of war products. Kerosene and residual-fuel production was subordinated in May to rates of 4.8 and 27.3 per cent, respectively, on crude, while distillate fuel output rose to 15.2 per cent, up 1.2 per cent from May 1943.

The sharp increase in demand for motor fuel, including essential civilian supplies, 80-octane, all-purpose military gasoline and 100-octane for the military air forces has lifted total production to about 39 per cent on crude charged to refineries. The current rate of gasoline production contrasts with average yields of around 35 per cent during the early part of 1943 before the Allied air forces and mechanized military strength was much more than a paper program. Forty-five new catalytic-cracking plants have been completed and 14 remain on the construction schedule, indicating that further rises in the percentage of gasoline produced per volume of crude oil processed will occur during remainder of the war. Yields of gasoline, however, remain substantially below the yields of 45-46 per cent during the last peacetime year and extending into 1942.

District 2 refineries, particularly, will be called upon during the last half for production of greater quantities of military products. Gasoline and products in the gas-oil and distillate fuel-oil range are sought in substantially larger volume from District 2 manufacturers. Middle West refiners have two alternatives in meeting the higher schedules of military products: (1) Deemphasize manufacture of civilian gasoline, and (2) increase tank-car shipments of West Texas crude oil in order to lift plant operations above the level of 1,185,000 bbl. which is the approximate ceiling under current supplies of crude.

Extensive Pipe-Line Construction Will Continue in Second Half

by Paul Reed

PIPE-LINE construction in the first half of 1944 has been very active with prospects for continuing so to the end of the year to provide for demands which have developed in the particular period of the war in which we are at present. This current phase of pipelining follows the post-Pearl Harbor one of 1942-43, which was primarily concerned with the projects costing $250,000,000 for petroleum transportation to the East Coast which were nearly all completed at the beginning of this year. Most of the 3,600 miles of major projects now under construction or completed since January are for natural-gas lines to meet the needs of northern industrial areas. The principal crude-oil pipe line building of 1944 has been planned for increasing movements from West Texas and in the Rocky Mountains. Laying of products lines, which was increasingly prominent in the pre-Pearl Harbor years, is overshadowed by gas and crude-oil projects for the duration.

The predominant project of 1944 is the 1,200-mile 24-in. natural-gas line of Tennessee Gas & Transmission Co. from Corpus Christi, Tex., to connections with lines of Columbia Gas & Electric Co. and Consolidated Natural Gas Co. Subsidiaries of the latter company are building 150 miles of 12-in. in West Virginia and Pennsylvania. The Tennessee gas project, under construction since early this year, is being pushed for completion early in the fall.

Hugoton Outlet Probable

Much attention is focused on proposals for increasing transmission of gas from the Hugoton field of Kansas, Oklahoma and Texas which is regarded as the largest known natural-gas reserve in the world. Following the completion this year of Cities Service Transportation & Chemical Co.'s Guymon-Blackwell, Okla., line, Kansas-Nebraska Natural Gas Co. has undertaken laying of the 155-mile Deerfield-Stockton, Kans., system. The prospects for early construction of additional outlets for the Hugoton field indicate that Kansas Consolidated Gas Co. will start laying pipe for a 215-mile, Hugoton-Wichita, Kans., line later this year. It is predicted that Phillips Petroleum Co. will be in a position soon afterward to build a line from the Panhandle and Hugoton fields to Wichita, Kans., and Kansas City, Mo.

Furthermore, Hugoton reserves are regarded as a possible future source for California where natural-gas supplies are approaching a serious state of depletion. Preliminary studies are reported to have been made by Pacific Lighting Corp. for a 900 to 1,000-mile line to the Pacific Coast. Two subsidiaries of the corporation are laying 71 miles and installing other facilities to serve underground-storage operations at the Goleta field, California, which would be important in a program for future handling of Hugoton gas in southern California.

The possibility of the early removal of legal obstacles to the piping of natural gas into Wisconsin means that a large new potential market is likely to be available soon for Hugoton and Panhandle fields. Natural Gas Pipeline Co. of America, which has a line to the Illinois-Wisconsin boundary, can begin serving Wisconsin by laying a few miles of pipe. It is predicted that other extensions and a considerable amount of looping may be undertaken to increase service to this potential market.

Although there has been frequent discussion of converting one or both of the War Emergency Pipelines, Inc., lines for gas transmission, there are no indications of steps being taken in that direction while the European campaign of the war is conducted on its present scale. Such conversion would entail construction of feeder and distribution lines.

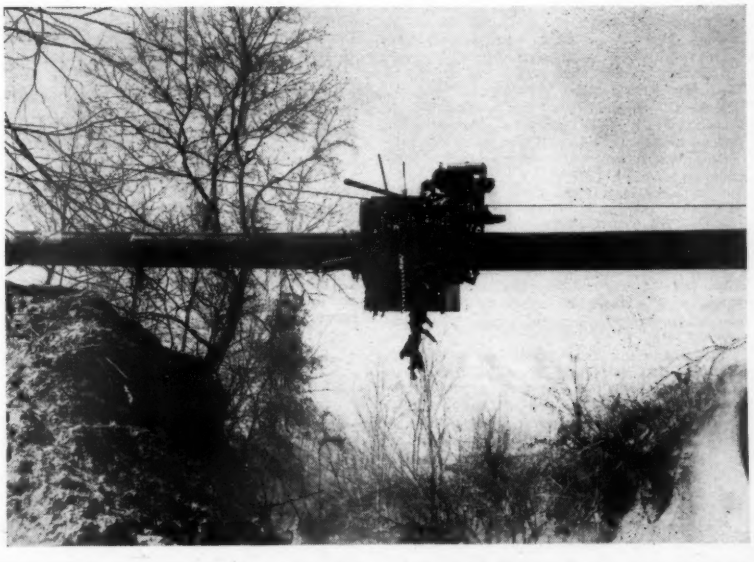
Much work is planned and already under way by Phillips Petroleum Co., Panhandle Eastern Pipe Line Co., and Northern Natural Gas Co. for enlarging facilities for transmitting gas from the Panhandle field.

West Texas in Spotlight

In plans for crude-oil movements, West Texas has been the center of attention this year. Facilities for increasing the movement of oil from that area have been provided by the laying of Magnolia Pipe Line Co.'s 12-in. line to Corsicana, Tex.; Stanolind Pipe Line Co.'s 16-in. line to Drumright, Okla., and Gulf Refining Co.'s looping to Weatherford, Tex. Because of the need to draw on West Texas more heavily than anticipated, owing to the fact that it is unlikely that western Kansas and Wyoming production will come up to previous expectations, Stanolind Pipe Line Co. is preparing to increase its trunk line so as to handle as much as 10,000 bbl. more of West Texas crude by looping between Drumright, Okla., and Sycamore, Kans.

Numerous short lines have been laid to move crude oil from new fields in Mississippi.

Among the recent large projects approved by Petroleum Administration for War is the 116-mile 16-in.



Coating and wrapping machine being pulled by wire line across wide ravine in rough country traversed in construction of Tennessee Gas & Transmission Co.'s 200-mile 24-in. line now being laid from Texas to West Virginia

crude-oil line in Venezuela, being built by a construction organization from the United States.

Work completed, now under way and in prospect indicates that 1944 will take its place among the big pipe-line years of the industry. Activity for this period represents a total of approximately 6,000 miles of line placed in service.

Completed crude-oil lines and those being laid for the principal projects in the first half of 1944 total about 1,150 miles; shorter crude lines for the period have been estimated to total 400 miles. Only 34 miles of products line have been laid. Natural gas lines completed and under way for principal projects in the first half of the year total 2,300 miles in addition to which shorter lines are estimated to account for 200 miles. These undertakings together with 116 miles of foreign crude line total 4,200 miles.

The status of PAW permits sought for construction in the second half of 1944 already gives assurance of at least 518 miles of crude oil and 185 miles of products lines, totaling 703 miles estimated to cost $10,800,000. Now pending before Federal Power Commission there are 16 applications for a total of 458 miles of interstate natural-gas lines estimated to cost $12,150,347; for these there are as yet no indications as to how much will be approved or when the approvals will be granted. The prospects for both intrastate and interstate lines are regarded as favorable for the laying of approximately 1,000 miles of natural-gas lines in the second half of 1944 in addition to the work included in the large program for the first half of the year.

Completions Increase 30 Per Cent First Half

(Continued from page 136)

ment of the new lower pay at Buena Vista Hills is also anticipated, and sufficient development is expected in the other fields to maintain production at present levels.

In the Rocky Mountain area the outstanding development was the completion of 27 producers and 1 dry hole out of 28 completions in the Elk Basin field. Oregon Basin had 14 oil wells and 3 dry holes out of 17 completions to take second place for activity in Wyoming. In Montana, completion activity was concentrated in the Cut Bank and Kevin-Sunburst areas, with 57 oil wells, 1 gas well and 16 dry holes for the former and 41 oil wells, 1 gas well and 9 dry holes for the latter.

Wildcatters were successful in Wyoming in the first half of 1944, with four discoveries in the Tensleep, one in the Dakota east of Lance Creek, one in the Muddy formation on the Cooper Cove structure in Albany County and the opening of a 58-gravity oil pool on Golden Eagle, Hot Springs County. The Tensleep discoveries were at Garland, Big Horn County; Little Buffalo basin, Park County; Steamboat Butte in Fremont County and Winkelman Dome, Fremont County.

Kansas activity, both wildcat and development, was concentrated along the Central Kansas uplift. There were 33 new pools opened in 16 counties during the first half of 1944, compared to 30 in the same period of 1943. All appeared likely to be about average.

Among the development activities, the Zenith-Peace Creek and Kraft-Prusa pools had 25 and 27 completions, respectively.

West Edmond Major Pool

In Oklahoma the West Edmond field producing from the Bois d'Arc section of the Hunton lime, displayed more and more characteristics of a major field during the first 6 months of 1944 and is now 9 miles long and averages about 2 miles over that length, as a result of completing 59 oil wells and 6 dry holes. The major optimism stems from prospects of developing Wilcox sand production in the Anadarko basin in the western half of the state, as a result of Carter Oil Co.'s successful wildcat in McClain County, about 24 miles due south of Oklahoma City.

Better than average success in wildcatting and development work in the southwestern and southern part of the state has encouraged activity from Beckham County in the southwest to Marshall County on the Texas line in the south central part of the state.

Illinois development in 1944 barely exceeded the 1943 first half. Five pools were opened in the first half of 1944, Mount Erie, North, in 3-1n-9e; Divide, West, in 15-1s-3e; Maple Grove, East, in 1-1n-10e; Keensburg, South, in 27-2s-13w, and Hoodville, East, in 35-5s-7e. Field development was most active in the Clay City Consolidated pool with 55 new wells; Mount Carmel in Wabash County with 34 new wells; the Albion pool in Edwards County with 28 new wells; the Concord pool in White County with 24 new wells, and the Iola pool of Clay County and the Schell pool of Richland County, each gaining 21 new wells.

Status of Major Pipe-Line Projects

CRUDE OIL

Magnolia Pipe Line Co., 337 miles of 12-in., Midland-Corsicana, Tex., completed in March. Capacity 42,000 bbl. daily, increased in May to 55,000 bbl. daily.

Gulf Refining Co., five loops totaling 75 miles of 10-in., West Texas to Weatherford, Tex., for increasing capacity of the trunk system from 70,000 to 80,000 bbl. daily.

Stanolind Pipe Line Co., 385 miles of 16-in., Slaughter, Tex., to Drumright, Okla., completed at end of March.

Stanolind Pipe Line Co., 235 miles of 12-in. from Elk Basin to Casper, Wyo.

Yale Oil Pipe Lines, Inc., 51 miles of 8-in. and 30 miles of 6-in., totaling 81 miles, to connect Elk Basin and Frannie fields, Wyoming, with refineries at Billings and Laurel, Mont.

Pan American Pipe Line Co., 34 miles of 8-in., capacity 10,000 bbl., Willamar field to Port Isabel, Tex.

NATURAL GAS

Tennessee Gas & Transmission Co., 1,200 miles of 24-in., Corpus Christi, Tex., to Kenova, Ky., and 80 miles of 18-in. for an extension to Cornwell, near Charleston, W. Va.

Cities Service Transportation & Chemical Co., 230 miles of 26-in., Guymon to Blackwell, Okla., completed in March.

Pacific Lighting Corp. subsidiaries: Southern California Gas Co., 10 miles of 22-in. and 27 miles of 18-in., Hollywood to Ventura, Calif.; **Southern Counties Gas Co.**, 34 miles of 16-in., Ventura to underground storage at Goleta, Calif. These projects total 71 miles.

Kansas-Nebraska Natural Gas Co., 40 miles of 18-in., 100 miles of 12-in. and 15 miles of 8-in. for a system totaling 155 miles for transmitting gas from Deerfield, Kans., in the Hugoton field to Stockton, Kans., to connect with existing line of the company.

Celanese Corp. of America, 90 miles of 24-in. for supplying plant in the Bishop, Tex., area.

Haynesville Operating Committee, 150 miles of 2-in. to 20-in. for Haynesville, La., unitized operations.

Phillips Petroleum Co., 170 miles of gas lines of various sizes to serve West Texas and Panhandle operations.

Consolidated Natural Gas Co. subsidiaries: Hope Natural Gas Co. and New York State Natural Gas Corp., 150 miles of 12-in., Wetzel, W. Va., to Clarion, Pa.

PRODUCTS

Texas Co., 34 miles of 4-in., Lockport, Ill.-East Chicago, Ill., scheduled for completion in July.

FOREIGN

Creole Petroleum Co., 116 miles of 16-in. crude oil line from Jusepin-Mulata to Puerto la Cruz, Venezuela.

Proposed Lines

CRUDE OIL

Stanolind Pipe Line Co. looping, 41 miles, 16-in., Drumright, Okla., to Sycamore, Kans.

PRODUCTS

Ohio Oil Co., 115 miles of 8-in., Robinson, Ill., to Indianapolis, Ind.

NATURAL GAS

Panhandle Eastern Pipe Line Co., 33 miles of 22-in. looping of trunk line across Oklahoma Panhandle.

Kansas Consolidated Gas Co., 215 miles of 16-in. from Hugoton field to Wichita, Kans.

Phillips Petroleum Co., 360 to 400 miles of 24-in. or 26-in. from Hugoton and Panhandle fields to Wichita and Kansas City, Mo.

El Paso Natural Gas Co., 44.61 miles of 12-in. from Eunice station, Lea County, New Mexico, to the company's 8-in. line.

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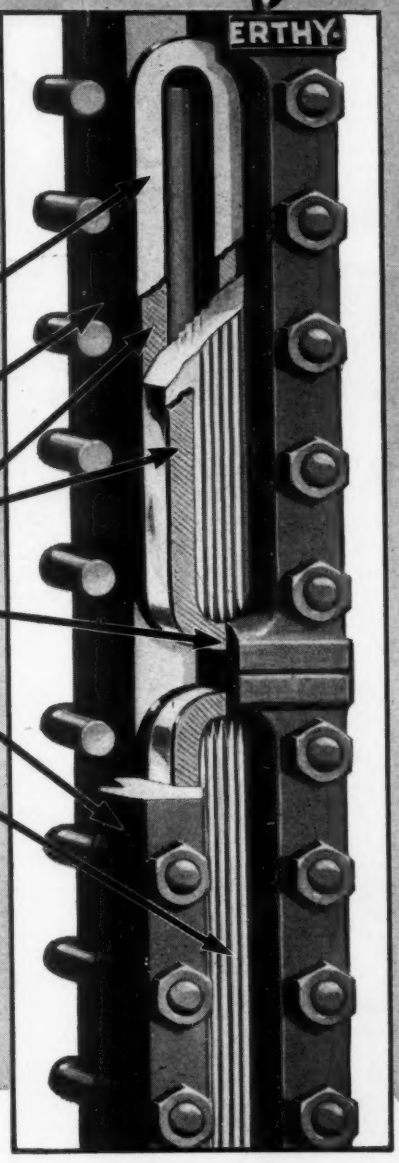

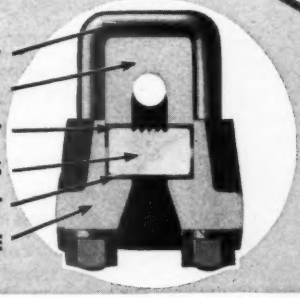

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Design and Construction of the Santa Maria Valley Absorption Plant

by D. E. McFaddin

THE Santa Maria Valley oil field was discovered by the Union Oil Co. of California back in 1934. The oil from this field is heavy, running about 15° A.P.I. gravity, and has a high sulfur content. During the first 3 years of the life of the field there was practically no demand for oil of this character and production was at a minimum. However, with the coming of World War II the demand increased so that now there is urgent demand for the maximum of oil production. The conservation and proper utilization of the gas associated with the increased oil production has consequently required the installation of gas treating and handling facilities.

In 1937 gas equipment was installed in the Santa Maria Valley field to compress about 5,000,000 cu. ft. per day of wet gas from 20-lb. gage to about 150 lb., and to remove the hydrogen sulfide content of the gas by means of an iron oxide bed and then to transport the gas through 7 miles of 6-in. pipe to Union Oil Co.'s Orcutt absorption plant, where facilities were available to recover the gasoline content of the gas and to deliver the surplus dry gas into the Southern Counties Gas Co. lines. This operation was satisfactory for several years, but by the early part of 1942 production had increased until it was apparent that a complete absorption plant was needed at Santa Maria Valley. It will be remembered that at this time very little new material was available for constructing an absorption plant, and it was necessary to comb the country for idle used equipment. Table 1 lists the major units of equipment and indicates their source. It is seen that nearly all of the major units were obtained from idle equipment which had previously been in service many years. All of this equipment was thoroughly reconditioned in the Union Oil Co. salvage shops at Santa Fe Springs. In some cases 15-year-old "bare rod" welding on pressure vessels was found to have a tensile strength insufficient to meet the desired working pressure. This bare rod welding was chipped out and the vessels rewelded according to modern standards. Pumps, safety valves and instruments were also a very difficult problem and many

D. E. McFaddin, senior process engineer of Union Oil Co., joined the corporation in March 1929 as a tester in the gasoline laboratory. In August 1932 he was transferred to the engineering department, then known as the development division, at the headquarters of the company in Los Angeles. Thereafter he spent some time on refinery research work and in August 1939 was transferred to the gas department as a member of the process engineer group. He was later promoted to senior process engineer and is recognized as an expert in this phase of operations, the fabrication of the Santa Maria Valley absorption plant and his refinery work being outstanding. He is a graduate of California Institute of Technology and is a member of the California Natural Gasoline Association, A.P.I., and other technical societies.

The Santa Maria Valley absorption plant built and operated by Union Oil Co. for production of natural gasoline and purification of residue to meet commercial specifications

This paper was presented at the July meeting of California Natural Gasoline Association, Los Angeles, July 6, 1944.

PROCESS FLOW DIAGRAM—SANTA MARIA VALLEY ABSORPTION PLANT

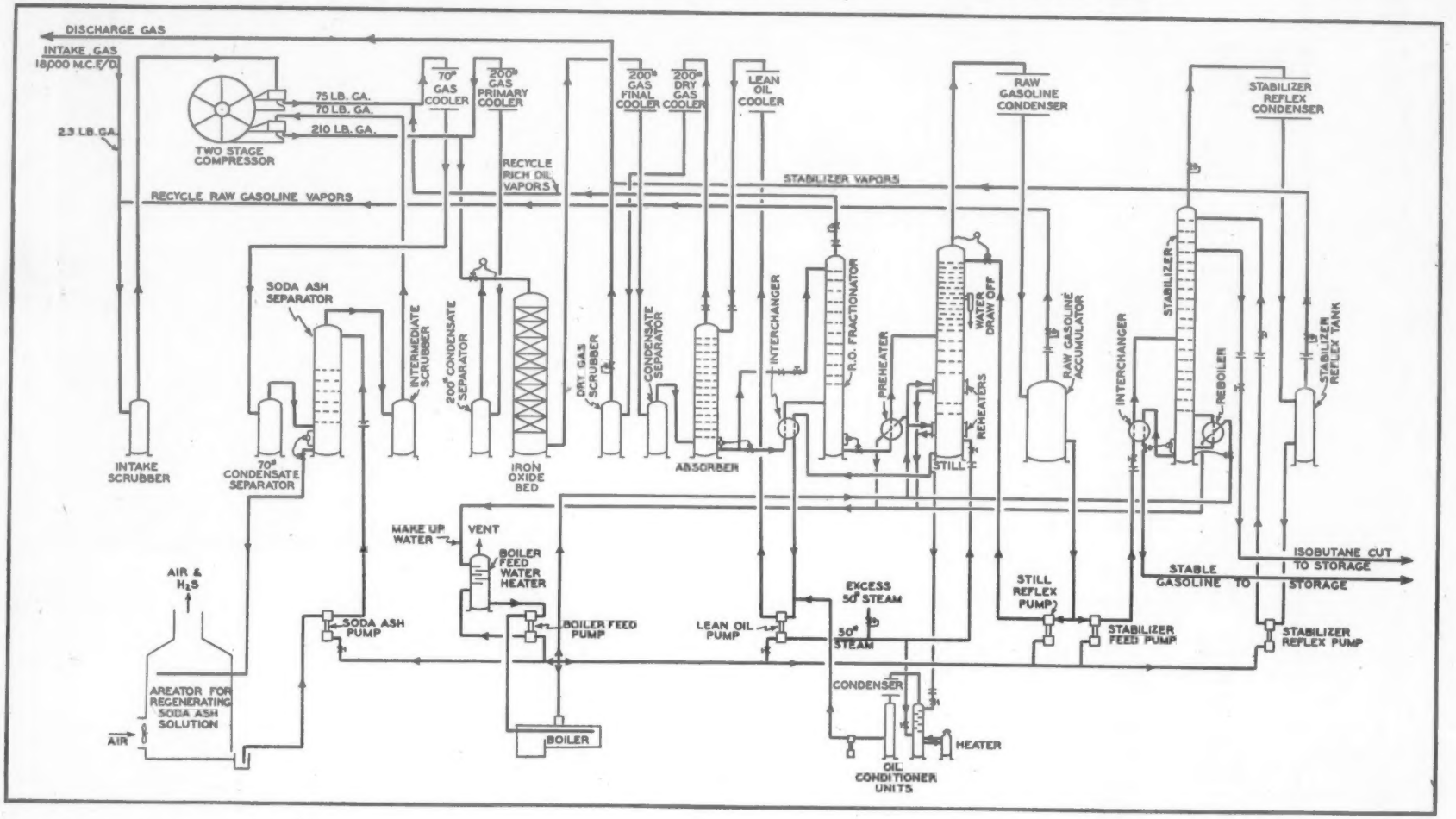


Fig. 1: Simplicity is the keynote in design and operation of this wartime plant built to handle a sour gas, removing the hydrogen sulfide to qualify the residue for domestic consumption

items of this class were rebuilt in Union Oil Co. shops from equipment which had long been discarded. Engineering and process and construction of a plant with such a limited availability of equipment presented many unusual problems. Nevertheless, with help from the War Production Board District 5 office, the necessary priorities were obtained and construction was started on April 15, 1943, and the plant was completed and put into operation December 30 of the same year.

The Santa Maria Valley absorption plant was designed to process a maximum of 18,000,000 cu. ft. per day with an absorption oil circulation of 16,000 gal. per hour and an absorber pressure of 190-lb. gage; extracting 80 per cent of the isobutane content, 97.5 per cent of the normal butane and 99.2 per cent of the pentanes and heavier content of the gas. Table 2 gives the over-all plant commodity balance. The gas from the field reaches the plant at approximately 23-lb. gage, and is compressed to 210 lb. in two stages. At the interstage pressure of about 75 lb. the gas is countercurrently contacted with 4 per cent soda ash solution to remove the major portion of the hydrogen sulfide. The remainder of the hydrogen sulfide is removed by iron oxide beds after the gas has been compressed to 210 lb. The isobutane and heavier fractions of the gas are then extracted from the gas by absorption oil circulated through absorbers operating at about 190 lb. The water vapor content of the absorption plant discharge gas is then removed in a Southern Counties Gas Co. dehydration plant, employing diethylene glycol, in order to prevent subsequent condensation and corrosion in the gas company's fuel-gas transportation and distribution system. A large portion of the plant discharge gas is utilized in the Santa Maria Valley area for domestic and industrial purposes. The remainder is transported to Union's Orcutt compression plant where it is compressed to 400 lb. and delivered into the Southern Counties Gas Co.'s main lines running to Santa Barbara.

The flow chart, Fig. 1, shows that the absorption-plant cycle is quite simple. There are two absorbers. Each is 46-in. i.d. and 24 ft. high and contains 15 perforated trays. The absorption oil is metered to the top of each absorber and flows from tray to tray downward, countercurrently against the rising gas. Liquid level controllers automatically hold a constant oil level in the bottom section of each absorber. The main stream of enriched oil from the bottoms of the absorbers flows through interchangers where it is heated to approximately 290° F. It then flows into a rich oil fractionator at 100 lb. pressure. This unit is installed to separate the major portion of the methane and ethane from the absorption oil and other absorbed fractions.

The gasoline content of the plant intake gas from the Santa Maria Valley oil field is unusually low. This fact has a direct bearing on the condensation and separation of the gasoline and isobutane and propane from the lighter absorbed fractions. When theoretical computations were made to determine the proper process cycle it was found that either a high-pressure (100 lb.) still, a rich-oil fractionator or some other facility was required which would eliminate the major portion of the methane and ethane from the cycle before the main (40 lb.) raw-gasoline condenser was reached. Otherwise these light fractions would prevent the satisfactory condensation of the other fractions, especially of propane and the butanes. The use of a 32-in. i.d. rich-oil fractionator was found to be the best suited to the present requirements at the Santa Maria Valley plant.

The rich oil and vapor from the interchangers at 290° F. enters the bottom section of the column where the liquid is separated from the vapor. The liquid flows out the bottom to the preheaters while the vapor rises upward through fractionating trays countercurrently against a stream of cold rich oil which flows direct from the 190-lb. absorbers to

(Continued on page 181)

Table 1—Source and Description of Main Units of the Santa Maria Valley Absorption Plant

Compressors

One 150-hp. Model XVG Ingersoll Rand compressor, 350 r.p.m.; one low-stage cylinder 12 by 14-in. with variable clearance; one high-stage cylinder, 8 by 14 in.

Eleven Cooper Type 80 twin compressors, 200 r.p.m.; one low-stage cylinder, 13 by 20 in., with clearance chambers; one high-stage cylinder, 8 by 20 in. The Coopers were fitted with special cams to enable developing the maximum horsepower. The Cooper power cylinders were also adapted to overhead air intakes and were equipped with Vortox air cleaners.

The Ingersoll Rand XVG and three of the Cooper 80's had been installed at the plant location prior to the construction of the absorption plant in 1943.

All the additional compressors had previously been in service at various locations many years and required extensive repair work before being put into service in the new plant. The Coopers are now developing about 185 b.hp. and were originally rated by the manufacturer at 175 b.hp.

Absorbers

Two 46-in. i.d. by 25-ft. high absorbers, previously used in a North Belridge absorption plant were adapted for use at Santa Maria. These vessels had been operated at 400 lb. gage for many years, but under present code standards they are rated at 200 lb. gage maximum allowable working pressure.

Each absorber has a computed maximum capacity of about 11,000,000 cu. ft. per day at 200 lb. gage with an oil circulation of 8,000 gal. per hour. In order to obtain this capacity the total number of perforations in each tray was increased from 1,900 to 5,700 and new larger inlet and outlet nozzles were installed. The perforations are 9/64-in. diameter. Each absorber originally had 16 trays. However, it was necessary to sacrifice one tray in each absorber to accommodate the new nozzles.

Interchangers

Six Braun F-155 units with a total heat transfer surface of 2,200 sq. ft. were obtained from a dismantled absorption plant at Elwood. They were installed in two parallel banks, each with three units in series. A heat transfer K of 100 B.t.u. per sq. ft. per degree F. temperature difference is being obtained with these units, which is very good performance.

Rich-Oil Fractionator

A 32-in. i.d. by 50-ft. high column with 22 bubble-cap trays was obtained for this service. It was formerly used as a stabilizer column in an Elwood absorption plant and originally had a maximum allowable working pressure of 250 lb. gage. However, this was reduced to 170 lb. gage in accordance with present safety-code standards.

Preheaters

Two Braun F 150 units with a total heat transfer surface of 750 sq. ft. were obtained from a dismantled plant at Elwood. These units are now performing with a heat transfer "K" of over 200 B.t.u. per sq. ft. per °F.

Fractionating-Stripping Still

A 60-in. i.d. by 55-ft. high column with 19 perforated trays was obtained from Union Oil Co.'s Bell absorption plant at Santa Fe Springs where it had been standing idle for about 10 years. It has a 55-lb. maximum allowable working pressure; built in oil reheaters, and facilities to withdraw stripping steam condensed within the fractionating section of the column. The perforations of the fractionating trays for this column had previously been drilled beyond the limit of efficient performance for the conditions at the Santa Maria absorption plant. Therefore about 50 per cent of the perforations were blanked off with plates of sheet metal. They are performing satisfactorily.

Stabilizer

A 32-in. i.d. by 77-ft. high column with 40 bubble-cap trays, together with interchangers and a reboiler, were obtained from Union Oil Co.'s absorption plant at Del Rey, where they were standing idle. They had been in corrosive service for about 12 years. However, after some repair work, a maximum allowable working pressure of 230 lb. was obtained which is only 20 lb. less than the 250-lb. working pressure allowed when the vessel was first built.

This vessel was originally equipped with a reflux condenser located on its top. This part of the equipment was in bad condition and was junked. The unit was then redesigned to operate with a reflux tank at ground level with condenser coils located in a cooling tower. The reboiler was also redesigned and augmented. Side drawoff connections were provided between the feed inlet and column top for the production of an isobutane cut or of liquefied petroleum gas.

Oil Conditioner

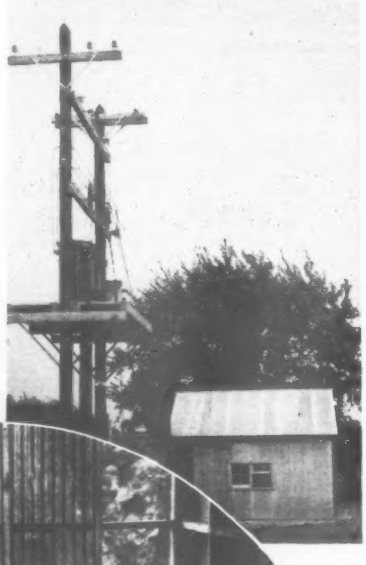
A 20-in. diameter oil conditioner was constructed entirely from salvaged material to separate gums and foreign matter from the oil.

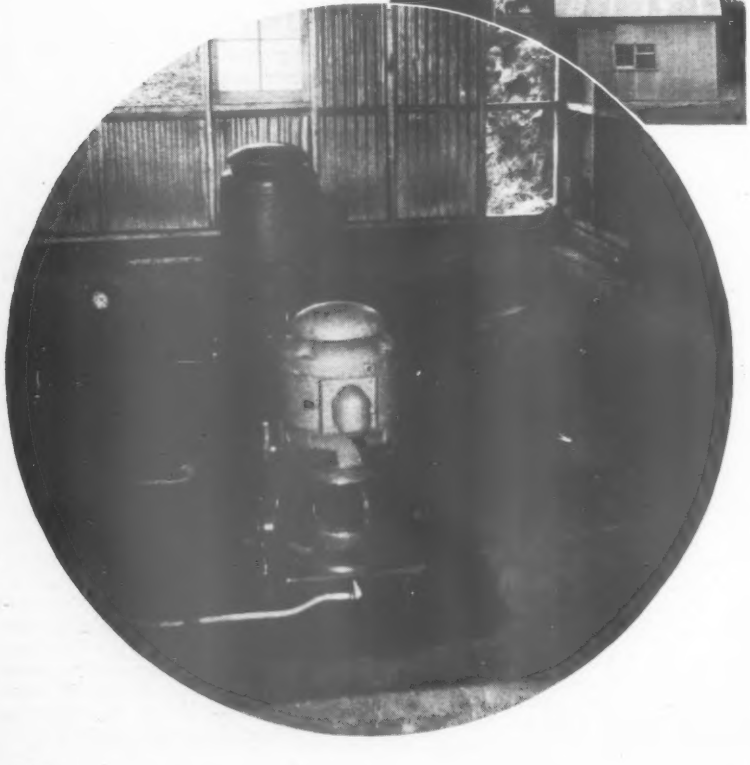
Compact and Enclosed Water-Flood System

by Frank B. Taylor

A HIGHLY compact water-flood plant has been put into operation in Linn County, eastern Kansas, on a Squirrel sand shoestring entering the county from the west and south.

The project incorporates a completely enclosed water lift-injection system operating from purchased power. The entire surface installation, simple in design, is a marked departure from usual practice. There are definite operational and economic advantages to the setup. A somewhat similar plan was used experimentally by Shell Oil Co., Inc., in another area and from this considerable discussion among water flood engineers arose as to the efficiency and applicability of the method with no generally acceptable conclusions being reached.





Purchased power installation and pump house at right. Below is an interior view of the pump house, showing the electrically powered turbine-type pump in the foreground and centrifugal pump in the background for operation of the completely enclosed system

Myron W. Matson is the operator, with C. M. Cordner as superintendent.

Flood water is obtained from Mississippi lime at 1,450 ft. with the second break in the formation supplying the greatest volume. Water in the Mississippi lime is general throughout the area at depths varying from 2,200 ft. in the west sectors of the secondary-recovery districts to 800 ft. in the extreme east of the state. In the latter sectors the lime does not always carry sufficient water for operations of this nature.

A turbine-type pump is hung 330 ft. down the water well casing. This depth is sufficient to provide satisfactory submergence as the water normally rose to within 150 ft. of the surface. The turbine is directly driven by a three-phase, 1,500-1,800 r.p.m. electric motor mounted on the concrete floor of the plant. This lift unit is capable of producing 80 gal. of water per minute.

Water from the well is discharged at 65 lb. pressure directly into a 4-in. line acting as the input to a centrifugal pump that discharges directly into the water-input system to the wells. Currently, the discharge from the 40-hp. centrifugal pump is at 650 lb. pressure. Between the turbine discharge and the centrifugal-pump intake is a distance of only about 8 ft. The water carrier between the two units consists of an expansion sleeve, a control valve and a mercoid pressure control that is set to automatically cut off pump power if the discharge pressure from the turbine unit drops below a predetermined minimum. Regulation of line pressure on the discharge side of the centrifugal pump and a control panel for incoming power completes the essential equipment.

Injection Carefully Controlled

This project has only been in active operation since March, this year, and as careful control of injection rates at each well has been maintained and also as the producers have been operated at outputs consistent with preinjection performance, no material change in production has been noted nor was any anticipated to date. By its manner of operation in holding back the producers, the project may be termed a semidelayed plan, a full delayed plan being the establishment of maximum sand or reservoir pressure throughout the project before production is started, or in some cases even before the producing wells have been drilled.

Fundamentally, water for flooding operations may be handled in two manners. The first and more common method is to treat completely by various chemical meth-

ods depending upon analysis of the raw water, to precipitate, to settle and filter. The end product, essentially pure and stable water, is then given necessary injection pressure and introduced into the input wells.

The second method, that by which the Matson project is being developed, is to confine the water flow in order to eliminate any chance of chemical or physical changes in the water used.

Long confinement of the Mississippi lime water in this stratum through geologic ages has resulted in that water reaching a fixed chemical and physical stability. In its native stratum, then, it is assumed to be an ideal flooding agent. If such water were to be subjected to the introduction of chemicals, or if allowed to come into contact with the atmosphere and the oxidizing action that would immediately result, or if it were allowed to be produced at no appreciable pressure, then the physical and chemical relationships inherent in the Mississippi lime reservoir would be changed, and this in turn would result in necessitating a complete chemical and restabilizing treatment for the water. By a minimum reduction in pressure, only sufficient to lift the water from the supply well, and with no chemical contact, the stability of the natural reservoir water is assumed to be retained and the water is therefore satisfactory for reinjection into the input wells with no clogging or other detrimental effect anticipated. The reaction of the input wells on the lease in their reception of the water supports this conclusion.

Project Plan

Squirrel sand (Pennsylvanian) at 575 ft. is being flooded in the project. Bartlesville sand is present in the area with a top at 650 ft., but it is dry. The pattern is the usual five-spot with almost all the wells (all input) having been redrilled prior to initiating the operation. Water was started into the wells at a rate of approximately 20 bbl. daily, a figure which has been increased 5 bbl. per day.

All input wells are equipped with volumetric meters and are controlled by a pinch valve to the well head. Water pressure is pinched at the plant for pressure control into the injection system and pressures ranging from 50 to 100 lb. are carried at individual wells. All input wells have their equipment housed as protection against grazing stock and weather.

Surface Cavities Are Problem In Bateman Field, North Texas

BATEMAN field, King County, North Texas, offers a rarity in hazards to otherwise normal rotary drilling operations. Irregular cavities and smaller crevices exist in the surface formation to depths of 250 ft., necessitating unusual care in starting the well.

On one well, drilled by E. C. Norwood Estate Drilling Co., mud pits were dug and a mix prepared and otherwise the well made ready to start. The next day, however, the mud was gone from the pit. Investigation revealed that the floor of the pit was not only sufficiently fractured and creviced to allow considerable mud loss, but in addition there were actual holes exposed in the gypsum floor of the pit. One of the men punched down through one of these holes with a long stick in an attempt to find bottom, but without success. In order to retain the use of the pit for mud, the floor was carefully inspected and slabs of shale were thrown over the worst openings and cemented in place. This stopped the loss.

In other instances where conditions were less severe, small crevices were sealed as soon as returns or cuttings began coming back from the drill. These apparently effectively sealed off the cracks in the pits, and prevented noticeable loss of fluid.

Condition Common to Area

A condition similar to that indicated by the pits was proved to exist where drilling was started in a number of the wells. One test showed caverns at 6, 30, 90, 120 and 200 ft. from the surface. Various additives were tried to retain circulation during drilling but none proved successful except where the conditions was considered minor. One hole was stuffed with brush cut from the location, and packed with cedar boughs, empty sacks, and quantities of seed hulls. Drilling was hardly resumed before circulation was again lost. Cement failed to provide more than temporary aid.

While this condition apparently is emphasized locally, it has been noticed in Childress and other nearby counties. There appears to be no correlation between the open sections of the gypsum bed.

The formations are not difficult to drill and no cases of stuck drill pipe have been reported. The practice is to use plenty of water through the pipe and to ignore the lack of returns. This has been done whenever required. After hole is made through the stratum to around 220-250 ft., the procedure is to run in a string of 9⅝-in. and cement in the 12¼-in. hole. From this point on to completion, drilling is normal. A single joint of 13⅜-in. has been used in two wells as a conductor.

Bateman field is a surface structure of rather large extent. Two pays are proven, at 3,650 and at 5,300 ft., with the field's deepest test having gone to granite at 6,380 ft.

The field was a 1943 discovery.

Lt. Col. Walter H. Ritterbusch, in the land department of Kewanee Oil Co., Tulsa, until he entered war service, has been serving as chief of services and supply at the Presque Isle (Me.) army air field, but will return to inactive status, it was announced last week. Colonel Ritterbusch was commissioned a major in August 1942, serving as supply officer at bases overseas with the South Atlantic Wing, Air Transport Command, until May 1943, when he was assigned to the North Atlantic Wing base at Presque Isle. He was commissioned lieutenant colonel in November 1943.

Robert Siddall, formerly scout in the Midland, Tex., office of Atlantic Refining Co., has been transferred to San Antonio, and his place has been taken by **David Beck,** from Amarillo. **Leo Walraven,** formerly in the drafting department of Atlantic's Dallas office, has been transferred to Midland.

W. B. Saulsbury, landman for Kerlyn Oil Co. in Amarillo, Tex., is in charge of a new division office opened by the company in Casper, Wyo. **Norval Ballard,** geologist in the Oklahoma City office, has been transferred to Casper, and **George Acuff,** also a member of the Oklahoma City staff, will be in charge of drilling tools and field operations in the Rocky Mountain area.

J. M. De Booy, recently appointed Netherlands minister of shipping, has resigned as managing director of Royal Dutch Co. for the Working of Oil Wells in the Dutch Indies, Ltd. **J. B. Aug Kessler** and **J. C. Van Panthaleon,** remaining directors, have asked the stockholders to name another director.

H. F. Worley, Tulsa, president of Foundation Oil Co., is in a hospital in that city recovering from a double operation.

Evaporation Loss

shouts a warning!

RE-ROOF with WIGGINS ROOFS!

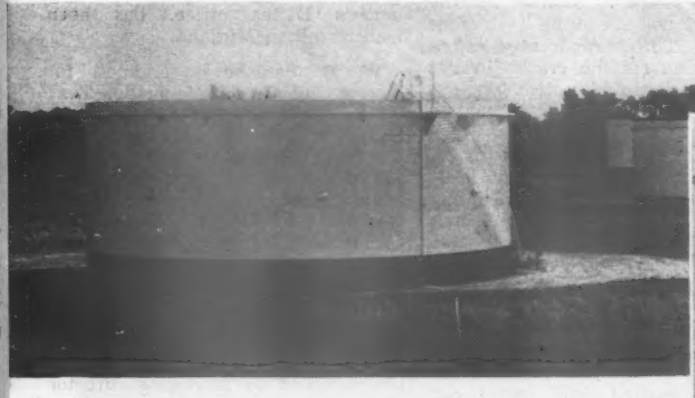
EXISTING TANKS WHOSE SHELLS ARE IN GOOD CONDITION MAY BE TRANSFORMED INTO EFFICIENT UNITS FOR STORING VOLATILE PRODUCTS WITH THE AID OF WIGGINS ROOFS.

For example, a 50,000-bbl. gas-tight fixed roof tank storing motor gasoline will lose through evaporation 100 bbls. during each complete filling plus ***1300 bbl. annually through breathing. On a tank of the same capacity equipped with a Wiggins Pontoon Roof the annual breathing loss would be reduced to 325 bbls. and the filling losses would be eliminated entirely!***

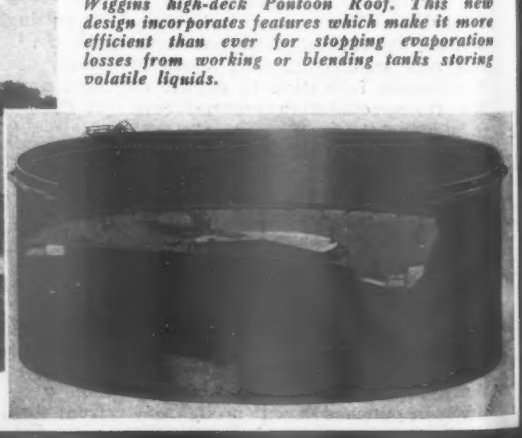
Given half-a-chance this saboteur, *evaporation*, will rob oil companies of untold quantities of valuable volatiles as well as thousands of dollars annually. Obviously, the laws of evaporation cannot be changed but you can place an effective *barrier* between the products stored and the atmosphere, that will effectively reduce evaporation to a minimum.

A Wiggins Roof is one of the most effective means of protecting volatiles that do not boil at ordinary atmospheric temperature against evaporation loss. There are three types of Wiggins Roofs . . . . . The Wiggins Pontoon Roof, the Wiggins Balloon Roof and the Wiggins Breather Roof. Each provide one of the simplest yet most effective methods of stopping evaporation for specific types of service. An important fact to keep in mind is that these vapor saving units may be used efficiently on either new or existing tanks whose shells are in good condition.

For more specific figures on the actual amount of savings afforded by Wiggins Roofs under given conditions—write our nearest office.



Shown below is a cut-a-way view of the new Wiggins high-deck Pontoon Roof. This new design incorporates features which make it more efficient than ever for stopping evaporation losses from working or blending tanks storing volatile liquids.

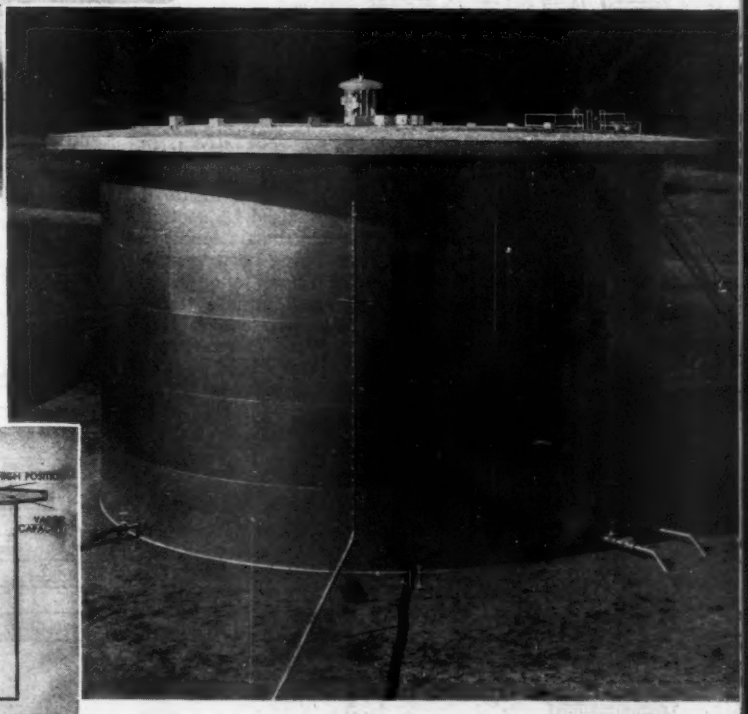


CHICAGO BRIDGE

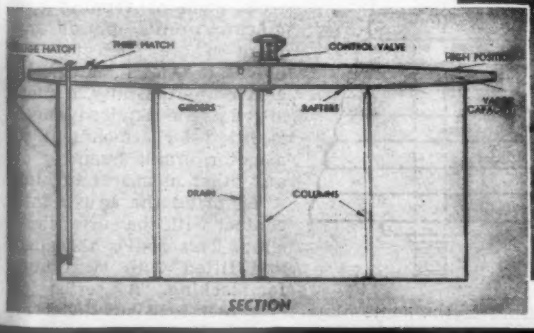
Chicago, 4 — 2128 McCormick Building
Cleveland, 15 — 2204 Guildhall Building
New York, 6, 3347-165 Broadway Building
Havana — 402 Edificio Abreu
Birmingham, 1 — 1536 North 50th Street

Plants at BIRMINGHAM, CHICAGO and GREENVILLE, PENNA.

WIGGINS Balloon Roofs are recommended for tanks of all sizes which are filled or emptied not more than six times a year. They reduce evaporation losses by providing a variable vapor space to accommodate vapor volume changes resulting from temperature variations. The unit shown below, located in Ill., is installed on a 25,000 bbl. storage tank.



WIGGINS Pontoon Roofs are recommended for tanks 15 ft. in diam. or larger. They prevent all filling losses and practically all breathing losses from tanks storing volatile products. These roofs also reduce boiling losses. The unit shown at the left on the opposite page is located at a pipe line station. It is 100 ft. in diam. and has a capacity of 55,000 bbls.



SECTION

& IRON COMPANY

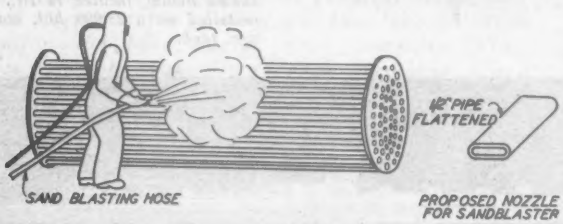
Tulsa, 3 1606 Hunt Building Philadelphia, 3 1615 Walnut St. Building
Houston, 1 5619 Clinton Drive Washington, 5 330 Bowen Building
San Francisco, 5 1054 Rialto Building
In Canada, HORTON STEEL WORKS, Limited, FORT ERIE, ONT.

PLANT PRACTICES

Here are presented some of the suggestions submitted by employes of Humble Oil & Refining Co. under the company's "Coin-Your-Idea" program. These suggestions resulted in cash awards to the men submitting them. Additional ideas will be published in subsequent issues of the Journal.

Cleaning Tube Bundles by Sandblasting

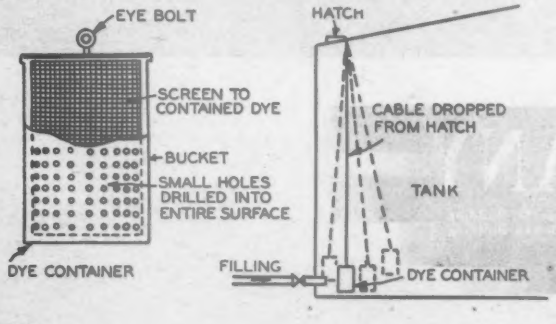
EXCHANGER tube bundles covered by hard scale offer serious problems in cleaning. Scraping has been the practice in general which proves expensive and time consuming. It has been found that sandblasting, by one workman with the usual protective equipment, can do this cleaning in 5 per cent or less of the time required for scraping. A bundle requires 5 to 12 hours for scraping. One may be cleaned in 30 minutes or



so by sandblasting. Conventional nozzles may be used, but for getting in between the tubes to those inside it is desirable that a special nozzle be devised. A section of pipe of small diameter, as ½-in., may be flattened to the thickness needed to permit its slipping between the tubes. This flattened nozzle must be long enough to reach as far as needed into the largest bundle to be cleaned. Heat-transfer rates in bundles so cleaned have been uniformly improved by this method as compared to scraping. The company paid the capital award of $750 for this idea. (Submitted by C. E. Crawford, junior metal inspector.)

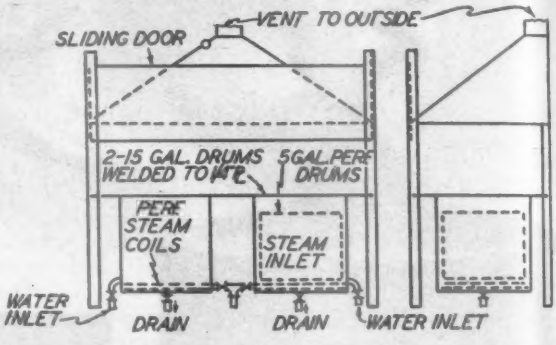
Screen for Holding Dyes

A CYLINDRICAL bucket is made of any perforated, nonsparking material, fitted with a cover clamped on or bolted. A cylinder of wire or other screen, which is rigid, is made to fit inside the bucket, and into this screen cylinder the dye, inhibitor or other solid material is placed. This container may be lowered by the eye-bolt in its lid, to the desired point in a mixing or storage tank as indicated in the drawing, to be dissolved and mixed in the liquid. (Idea submitted by Ernest Cline, pumping and gaging department.)



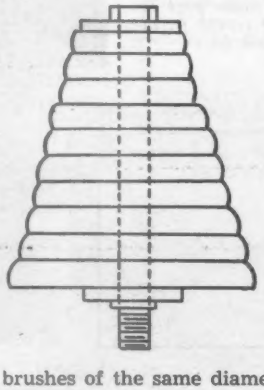
Laboratory Arrangement for Cleaning Valves and Fittings

THIS arrangement is made within a fume hood such as is used in all petroleum laboratories. Two vats of desired size are fitted side by side in the hood with steam inlets to perforated steam coils in each vat, near its bottom. Perforated buckets or "nets" are used to contain the fittings. Water is inleted to the vats near their outer, lower edges, and drains are provided from the center of the bottoms. These vats may be made of ¼-in. plate cut to proper size and welded together, also may



be welded to supports behind them such as wall beams or other suitable objects. In operation, the valves, etc., to be cleaned are placed in the perforated bucket or net and lowered into a solution of a cleaner such as Oakite, which is kept boiling by the steam. After a suitable length of time the bucket and contents are raised, drained, and transferred to the other vat containing boiling water, where all cleaner is removed and are dried and oiled for storage or are handled by any desired method. (Idea submitted by L. Williams, maintenance man.)

Tapered Wire Cleaning Brush



THIS simple expedient is for cleaning the tapered seats of header plugs in still coils, such as topping and cracking units, or at any point where such tapered holes are and must be cleaned periodically. A metal rod of the required length is fitted for attachment to a motor, crank assembly or any other means of turning it or bring the brush into contact with the surface desired. This rod is threaded and fitted with twin nuts for locking. A series of brushes of the same diameter center hole but different outer diameters are obtained and placed on the rod or shaft, placing the first or largest nearest the driving mechanism, the smallest at the end of the rod. A variation of this is to close off the outer end of the rod with a welded-on head, and install lock nuts on the driving end. By this latter means cleaner of differing maximum or minimum diameter may be assembled by using the required sizes of brushes. (Idea submitted by Charles Wyble, boilermaker department.)

THERMAL REFORMING For Olefin Production

by Dr. Gustav Egloff*

Thermal reforming of light fractions can be relied on to produce motor fuels of improved octane number and to make large quantities of light olefins suitable for charge stocks for alkylation and polymerization processes. Octane number of the motor fuel, and yields of olefins are generally in direct ratio to the severity of cracking conditions employed. A number of analyses of products from different charge stocks, especially Mid-Continent and California naphthas, are given here to illustrate results obtainable.

AT the 1943 annual meeting of the American Petroleum Institute, important studies were presented on increased severity of thermal reforming to increase particularly the yield of butylenes for polymerization or alkylation processes and to raise the octane ratings of the gasolines produced. The data presented indicate the ability of cracking tubes to operate at increased temperatures in reforming gasolines or naphthas.

In the studies[1,2] it was shown that the safe life of cracking tubes can be predicted by using formulas which involve tube dimensions, pressures, temperatures, heat input rates, and constants depending on the composition of the tube metals used. The studies were concerned with various types of tube metals. The first presented data on 5 per cent chrome-molybdenum steel tubes, 18-8 chrome-nickel tubes, and carbon steel tubes. In the second, the radiant section of the furnace contained carbon steel tubes, 2 per cent chrome tubes, and 4 to 6 per cent chrome tubes. It was estimated that a reforming unit operating on a virgin naphtha should produce 9.5 volume per cent of butylenes at 1,000 lb. per sq. in., with an outside tube metal temperature limit of 1,200° F.; a metal temperature of 1,300° F. at the same pressure should produce 11 per cent of butylenes; and at 1,540° F. and a pressure of 400 lb. per sq. in. 13.35 per cent. The authors concluded that within a reasonable factor of safety, the degree of cracking severity "is strictly a matter of tube replacement cost—and enhanced product value." From this standpoint it may be more profitable to operate under conditions corresponding to lower than normal tube life both in wartime, when yield and quality of products are primary considerations, and in peacetime, when tube materials are more readily available and lower priced.

*Director of research, Universal Oil Products Co.

TABLE 1—BUTYLENE YIELD FROM SEVERE NAPHTHA REFORMING

Test No.—	1	2	3
Charge:			
Gr. °A.P.I.	61.6	61.6	61.6
I.b.p., °F.	....	....	....
50 per cent	247	247	247
E.b.p.	404	404	404
Octane No. (A.S.T.M.)	50	50	50
Operating conditions:			
Temp., coil inlet, °F.	236	263	256
Temp., coil outlet, °F.	1,070	1,150	1,200
Max. tube metal temp. °F.	1,308	1,430	1,445
Pressure:			
Coil inlet p.s.i.g.	563	517	490
Coil outlet p.s.i.g.	175	195	195
Feed rate, b.p.s.d.	5,160	3,570	3,520
Products:			
Gasoline, 10 lb. R.v.p., vol. per cent	97.0	61.1	56.1
Octane No. (A.S.T.M.)	61	75	76
Butylenes, vol. per cent	1.8	7.7	9.8
Butylenes, b.p.s.d	93	275	345

In the second study[3], commercial data were presented showing the effect of increased temperature on yield of butylenes, and on yield and octane number of gasoline when reforming a naphtha. The data shown in Table 1 were obtained in a unit built in 1927 for 750 lb. per sq. in. which had operated at increased temperatures for seven months in 1943 without a tube failure and was still in operation when the A.P.I. report was made last November. The most striking data are those showing the increases in butylene yield, which was 1.8 volume per cent at 1,070° F. coil outlet temperature, 7.7 per cent at 1,150° F., and 9.8 per cent at 1,200° F. The gasoline yield dropped from 97 to 56.1 volume per cent as the octane number rose from 61 to 76.

Reforming of Straightrun Gasolines and Naphthas

Using a single-coil pilot plant, a number of gasolines, naphthas, and

A typical U.O.P. thermal reforming and Dubbs cracking unit in California

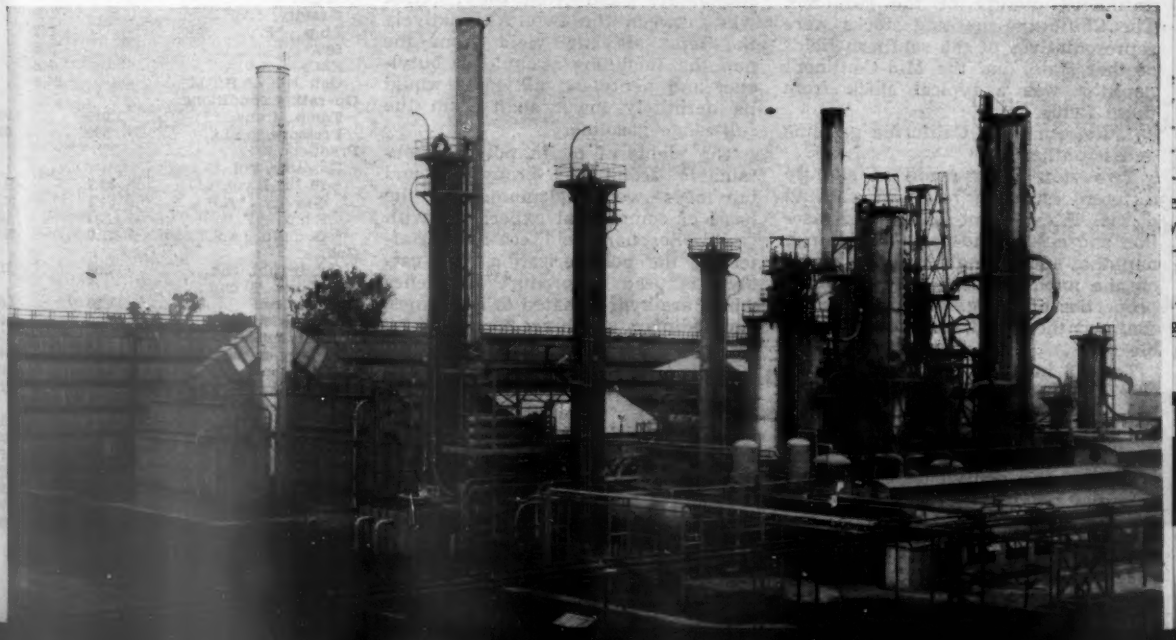


TABLE 2—PROPERTIES OF CALIFORNIA GASOLINE AND NAPHTHA

Stock—	Light straightrun gasoline	230°-400° F. straight-run naphtha	Blend of 30% light gasoline 70% naphtha
Gravity, °A.P.I., at 60° F.	66.4	48.7	53.2
Specific gravity at 60° F.	0.7150	0.7852	0.7661
Total sulfur, per cent	0.03	0.12	0.06
Mercaptan sulfur, per cent	sweet	sweet	sweet
Bromine No.	0.6	1.4	1.0
Reid vapor pressure, lb.	6.7	0.5	2.6
Octane No. (A.S.T.M.) clear	73.0	56.5	61.2
+ 3 cc. TEL per gal.	88.0	72.0	76.9
Composition, weight per cent by PONA:			
Paraffins and naphthenes	97	88	93
Olefins	0	1	1
Aromatics	3	11	6

TABLE 3—REFORMING CALIFORNIA GASOLINE AND NAPHTHA

	California		
	Full range gaso.		Naphtha
Charge:			
Gravity, °A.P.I.	53.2		48.7
I.b.p., °F.	145		234
50 per cent	271		299
E.b.p.	400		400
Octane No. (A.S.T.M.)	61.2		56.5
Operating conditions:			
Temperature, trans., °F.	1,030	1,030	1,020
Pressure, p.s.i.g.	750	750	750
Relative charge rate	1.47	1.54	1.50
Products:			
Gasoline, vol. per cent chg.	81.3	86.9	86.4
Gravity, °A.P.I.	54.7	54.9	51.5
E.b.p., °F.	400	400	401
R.v.p.	10	10	10
Octane No. (A.S.T.M.)	77.9	77.3	78.2
Gas:			
Cu. ft. per bbl. chg.	603	512	528
Ethylene, liq. vol. per cent chg.	1.18	1.34	1.00
Propylene, liq. vol. per cent chg.	4.10	3.20	3.60
Butylenes, liq. vol. per cent chg.	4.70	4.50	4.60
Pentylenes, liq. vol. per cent chg.	4.90	4.80	3.50
n-Butane, liq. vol. per cent chg.	1.00	0.57	0.63
i-Butane, liq. vol. per cent chg.	0.79	0.40	0.49
C_3 polymers, vol. per cent chg.	2.48	1.94	2.18
C_4 polymers, vol. per cent chg.	3.26	3.12	3.20
Total polymers, vol. per cent chg.	5.74	5.06	5.38
C_3 alkylate, vol. per cent chg.	4.26	3.32	3.75
C_4 alkylate, vol. per cent chg.	6.40	6.10	6.23
C_5 alkylate, vol. per cent chg.	6.42	6.30	4.60
Total alkylate, vol. per cent chg.	17.08	15.72	14.58

blends were subjected to once-through thermal reforming under varying temperatures, pressures, and charging rates to determine the effects of these variables upon the yield of ethylene, propylene, butylenes, and pentylenes, and upon the yield and antiknock quality of the gasolines. The California charging stocks were representatives of the southern fields of that state, and the Mid-Continent naphtha was a typical stock from these fields.

1. Reforming of California gasoline and naphtha.

Two runs were made at slightly different charging rates on a blend of 240° F. end-point straightrun gasoline and a 400° end-point straightrun naphtha, and a single run was made on the naphtha alone. The principal properties of the gasoline, the naphtha, and the blend are shown in Table 2.

Table 3 includes the principal data obtained. The increased charging rate in the second run on the gasoline had the effect of slightly decreasing the yield of butylenes and the yield of propylene and pentylenes so that the potential polymer or alkylate yields are lower. The yield of butylenes from the naphtha was the same as that obtained from the full-range gasoline, although the yield of pentylenes was less. The calculated propylene and butylene polymer yields were less in the second run on the gasoline than in the first, and the corresponding yield from the naphtha was between the two. Alternatively the total alkylate yield from the naphtha including propylene, butylene, and pentylene alkylates would be definitely lower than from the full-range gasoline.

The yields of olefin polymers obtainable from the propylene and butylenes were calculated on the basis of commercial experience with "solid phosphoric acid" catalyst for effecting the polymerization. The catalyst is used to produce isooctenes which are hydrogenated to isooctanes, and codimers which are converted by hydrogenation into hydrocodimer for aviation-fuel blending.

The alkylates producible by interacting the C_3, C_4, and C_5 olefins respectively, with isobutane in the presence of sulfuric acid or hydrogen fluoride catalyst were also calculated to indicate possible production using all the olefins for alkylation and none for polymerization. The amount of isobutane produced directly and that produced by isomerization of normal butane are insufficient for reaction with all the olefins. If it is desired to produce maximum amounts of alkylate, outside supplies of isobutane must be obtained. Yields of alkylates are based on dependanized rerun material having a 325° F. end point and 2.5 lb. R.v.p. The alkylate from propylene has an octane number (A.S.T.M.) of about 91, that from butylenes about 93, and that from pentylenes about 91.

In respect to octane number of the gasolines, the charging rate increase in the second run caused a slight drop from 77.9 to 77.3, while the percentage of gasoline recovered increased from 81.3 to 86.9. The run on the naphtha alone gave an octane number of 78.2, slightly higher than that obtained using gasoline as charging stock. Thus the blend of the original light gasoline having a 73-octane number with the reformed gasoline from the naphtha would have a rating considerably lower than that obtained in reforming the full range gasoline. Capacity and yield considerations might, however, indicate that it was more feasible to reform the naphtha to a still higher octane number product for blending with the light gasoline.

2. Reforming a blend of Rio Bravo gasoline and Mt. View naphtha (California).

A series of runs was conducted on a blend of 70 per cent straightrun gasoline and 30 per cent of naphtha, in which the temperature was varied from 1,010° to 1,060° F. at a pressure of 500 lb. per sq. in., and a constant feed rate. Table 4 shows the proper-

TABLE 4—REFORMING CALIFORNIA GASOLINE-NAPHTHA BLEND

	California mixture 70% Rio Bravo S.R. gasoline, 30% Mt. View naphtha	
Charge:		
Gravity, °A.P.I.	49.9	
I.b.p., °F.	142	
50%	308	
E.b.p.	448	
Oct. No. (A.S.T.M.	55.3	
Operating conditions:		
Temp., trans., °F.	1,010	1,060
Pressure, p.s.i.g.	500	500
Products:		
Gasoline, vol. % chg.		
10 lb. R.v.p.	82.7	71.4
Gravity, °A.P.I.	54.1	52.1
E.b.p., °F.	399	400
Oct. No. (A.S.T.M.)	71.0	75.9
Gas:		
Cu. ft./bbl. chg.	306	714
Liq. vol. % chg.:		
Ethylene	1.26	1.68
Propylene	3.20	5.50
Butylenes	3.50	6.10
Pentylenes	2.60	4.40
n-Butane	0.55	0.91
i-Butane	....	1.21
Vol. % chg.		
C_3 polymers	1.94	3.34
C_4 polymers	2.43	4.23
Total polymers	4.37	7.57
C_3 alkylate	3.32	5.70
C_4 alkylate	4.75	8.28
C_5 alkylate	3.40	5.78
Total alkylate	11.47	19.76

ties of the charge and the results obtained at two temperatures. The yields of butylenes were almost doubled at the higher temperature, and the yields of ethylene, propylene, and pentylenes were all greater. Thus the potential yields of polymers or alkylates were increased considerably. The calculated total C_3 and C_4 polymers went up from 4.37 to 7.57 liquid volume per cent, and the total alkylate alternatively went from 11.47 to 19.76 per cent based on the charge.

The octane number of the reformed gasoline was 71 at the lower temperature and 76 at the higher, with a decrease in yield fom 82.7 volume per cent at the lower temperature to 71.4 per cent at the higher.

3. Reforming California straightrun gasoline from mixed crudes.

A straightrun gasoline distilled from a mixture of California crudes and having a 380° end point was reformed under varying temperatures, pressures, and charging rates to determine the effects of these variables. The temperatures used ranged from 980° to 1,080° F., the pressures from 300 to 750 lb. per sq. in., and the relative charging rates from 1.00 to 1.50. The principal properties of the gasoline and the data are in Table 5.

The most pronounced effect was observed in the yields of C_3, C_4, and C_5 olefins which furnished the basis for arriving at the potential yields of either polymers or alkylates. As the temperature was stepped up from 1,030° to 1,080° F., the potential C_3 and C_4 polymers increased from 6 to 9.82 liquid volume per cent of charge, or the total alkylate using C_3, C_4, and C_5 olefins increased from 16.75 volume per cent to 24.69 per cent based on the charge. These yield increases also corresponded to a pressure reduction from 750 to 300 lb. per sq. in., and a decrease in charging rate from 1.26 to 1.00.

As the temperature was increased, and the charging rate and pressure were decreased, the octane number of the reformed product was improved and the potential polymer or alkylate yields were higher. The highest octane number and yield of gasoline were obtained at 1,050° F. and 500 lb. per sq. in., although the end point of the gasoline giving the maximum octane number of 76.9 was 356° F. compared with the end point of 374° F. on the gasoline of 76.3 octane number when operating under a pressure of 300 lb. per sq. in.

4. Reforming California naphtha.

A California straightrun naphtha having an end point of 444° F. was reformed at temperatures varying from 1,040° to 1,140° F., pressures from 100 to 500 lb. per sq. in., and charging rates varying from 0.78 to 1.50. The principal properties of the naphtha, and the results obtained in the reforming operations are given in Table 6. In these runs the highest yield of butylenes of 3.5 per cent was obtained at a temperature of 1,100° F., a pressure of 305 lb. per sq. in., and a charging rate of 1.50. In the runs at 1,140° F. and 100 lb. per sq. in., the charging rate of 0.78 gave increased yields of ethylene and propylene but the same yield of butylenes as in the preceding run at the 1.50 rate. The run at 1,100° F., and 305 lb. per sq. in. gave over 3 times the yield of butylenes that was obtained at 1,040° F. and 295 lb. per sq. in. employing the same charging rate. The total potential C_3 and C_4 polymer gasoline or alkylate, 6.7 and 12.13 per cent respectively, were highest in the 1,100° F., 305 lb. per sq. in. run.

Increased temperature and decreased pressure had the same effect on octane number that was observed in the case of the California mixed gasolines. The highest octane number of 80 was obtained in the run which corresponded to a temperature of 1,140° F., a pressure of 100 lb. per sq. in., and a charge rate of 0.78. The preceding run which used about double the charge rate gave an octane number of 76.9. The highest octane number gasoline contained the highest weight per cent of aromatics.

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formed under combinations of temperatures, pressures, and charging rates to determine the effect of these variables on yields of butylenes and other olefins, and on octane ratings. Temperatures from 1,040° to 1,160° F. were employed in combination with pressures from 100 to 500 lb. per sq. in., and charging rates from 0.78 to 1.53. The principle properties of the naphtha and the data obtained in 10 runs are given in Table 7. Again the highest yield of olefins polymerizable to polymer gasoline or utilizable for alkylating isobutane was obtained at the highest temperature of 1,160° F., the lowest pressure of 100 lb. per sq. in., and the lowest feed rate of 0.78.

The effect of doubling the charging rate can be seen in the immediately preceding run in which the butylene yield dropped from 5.5 to 4, the propylene from 13.6 to 11.7, and the ethylene from 11.5 to 9.68 volume per cent of charge. At 1,160° F. the effect of increasing the pressure from 100 to 300 lb. per sq. in. was to reduce the olefin yields markedly. The yield of ethylene dropped from 9.68 to 3.35 volume per cent of charge, propylene from 11.7 to 5.6 per cent, and butylenes from 4 to 1.8 per cent. At 100 lb. per sq. in. the calculated C_3 and C_4 polymers totaled 9.98 per cent by volume of charge, and 4.64 per cent at 300 lb. per sq. in. Alternatively the total C_3 and C_4 alkylate would be 17.64 volume per cent at 100 lb. per sq. in., and 8.25 per cent at 300 lb. per sq. in.

Summary

Marked increases of gaseous olefins for use in subsequent syntheses can be obtained by increasing the intensity of reforming conditions employed on gasolines and naphthas. Optimum yields of butylenes correspond to temperatures ranging from 1,100° to 1,200° F., and pressures from 100 to 300 lb. per sq. in., depending upon the composition and boiling range of the charging stock. At the present time such stepped-up operations are well worth while in view of the increased yields of olefins and the higher octane numbers of the gasolines. The aromatic contents of the liquid products are also higher, although apparently maximum aromatic production is obtained at somewhat higher pressures than those giving the best yields of olefins.

TABLE 5—REFORMING CALIFORNIA MIXED GASOLINES

Charge: Gravity, 54.4° A.P.I.; I.b.p., 116° F.; 50 per cent, 265; E.b.p., 379; Octane No. (A.S.T.M.), 63.

Operating conditions:						
Temperature, trans., °F.	980	1,030	1,010	1,050	1,058	1,090
Pressure, p.s.i.g.	750	750	500	500	300	300
Relative charge rate	1.54	1.26	1.47	1.01	1.58	1.09
Products:						
Gasoline, volume per cent chg.						
Actual, R.v.p.	95.1	89.9	90.4	89.9	90.5	87.0
10 lb. R.v.p.	....	72.7	....	72.8	....	68.8
Gravity, °A.P.I.	56.2	53.7	55.1	54.2	55.1	52.7
E.b.p., °F.	372	388	367	356	379	374
R.v.p.	10	10	10	10	10	10
Octane No. (A.S.T.M.)	70.4	76.7	71.8	76.9	73.0	76.3
Gas:						
Cu. ft. per bbl. chg.	202	681	294	807	386	865
Ethylene, liq. vol. per cent	0.69	1.12	1.04	2.03	2.06	3.24
Propylene, liq. vol. per cent	....	4.40	2.70	5.80	....	8.20
Butylenes, liq. vol. per cent	....	4.80	2.90	5.60	....	7.00
Pentylenes, liq. vol. per cent	....	4.30	....	4.40	....	5.10
n-Butane, liq. vol. per cent	0.45	1.69	0.89	1.76	0.87	1.43
i-Butane, liq. vol. per cent	....	1.38	....	1.25	....	0 88
C_3 polymers, vol. per cent	....	2.67	1.64	3.52	....	4.97
C_4 polymers, vol. per cent	....	3.33	2.02	3.89	....	4.85
Total polymers, per cent	....	6.00	3.66	7.41	....	9.82
C_3 alkylate, vol. per cent	....	4.59	2.80	6.02	....	8.51
C_4 alkylate, vol. per cent	....	6.53	3.94	7.60	....	9.50
C_3 alkylate, vol. per cent	....	5.63	....	5.78	....	6.68
Total alkylate, vol. per cent	....	16.75	....	19.81	....	24.69

TABLE 6—REFORMING CALIFORNIA STRAIGHTRUN NAPHTHA

Charge: Gravity, 45.4° A.P.I.; I.b.p., 248° F.; 50 per cent, 334; E.b.p., 444; Octane No. (A.S.T.M.), 52.6.

Operating conditions:						
Temperature, trans., °F.	1,080	1,140	1,140	1,040	1,100	1,060
Pressure, p.s.i.g.	100	100	100	295	305	500
Relative charge rate	1.50	1.50	0.78	1.51	1.50	1.50
Products:						
Gasoline, vol. per cent chg.	80.0	70.2	59.6	77.0	61.6	67.0
Gravity, °A.P.I.	49.2	48.4	46.7	49.8	46.6	48.4
E.b.p., °F.	400	394	394	406	415	400
Octane No. (A.S.T.M.)	71.0	76.9	80.0	73.0	79.2	77.9
Aromatics, weight, per cent	16	27	38	21	37	27
Gas:						
Cu. ft. per bbl. chg.	279	784	1,170	406	1,000	824
Ethylene, liq. vol. per cent chg.	2.35	5.80	9.40	2.15	3.65	1.56
Propylene, liq. vol. per cent chg.	2.00	4.70	6.30	3.30	7.10	5.10
Butylenes, liq. vol. per cent chg.	0.90	2.70	2.70	1.00	3.50	2.30
Pentylenes, liq. vol. per cent chg.	....	....	....	....	....	....
n-Butane, liq. vol. per cent chg.	0.13	0.18	0.09	0.18	0.82	1.05
i-Butane, liq. vol. per cent chg.	....	0.55	0.54	0.44	1.22	1.43
C_3 polymers, vol. per cent chg.	1.21	2.85	3.82	2.00	4.27	3.10
C_4 polymers, vol. per cent chg.	0.62	1.88	1.88	0.69	2.43	1.59
Total polymers, vol. per cent chg.	1.83	4.73	5.70	2.69	6.70	4.69
C_3 alkylate, vol. per cent chg.	2.06	4.90	6.55	3.44	7.38	5.30
C_4 alkylate, vol. per cent chg.	1.22	3.67	3.67	1.36	4.75	3.12

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2. McConnell, E. B., Proceedings 24th Annual Meeting American Petroleum Institute, Sec. III, Refining, November 8-11 1943; Nat. Pet. News, 35, 48, R-562 (1943).

TABLE 7—REFORMING MID-CONTINENT NAPHTHA

Charge: Gravity, 52.7° A.P.I.; I.b.p., 232° F.; 50 per cent, 312; E.b.p., 393; Octane No. (A.S.T.M.), 37.5.

Operating conditions:										
Temperature, trans., °F.	1,120	1,160	1,160	1,160	1,120	1,120	1,120	1,120	1,040	1,04
Pressure, p.s.i.g.	100	100	100	300	300	300	300	300	500	50
Relative charge rate	1.50	1.53	0.78	1.55	1.50	1.05	1.25	1.51	1.48	1.4
Products:										
Gasoline, vol. per cent chg.	79.3	65.4	50.9	72.4	53.1	45.5	44.9	50.2	72.6	57.
Gravity, °A.P.I.	54.7	52.5	51.3	55.2	50.9	51.1	53.8	53.8	55.4	52.
E.b.p., °F.	382	390	375	386	410	385	340	352	380	40
Octane No. (A.S.T.M.)	64.8	70.6	76.0	66.9	75.6	77.3	79.0	77.5	71.0	75
Aromatics, weight, per cent	17	24	30	19	37	35	32.5	29	16	3
Gas:										
Cu. ft. per bbl. chg.	667	1,083	1,497	546	1,257	1,449	1,300	1,190	663	1,05
Ethylene, liq. vol. per cent chg.	6.10	9.68	11.50	3.35	5.60	....	6.70	6.46	2.59	3.0
Propylene, liq. vol. per cent chg.	7.20	11.70	13.60	5.60	10.30	....	8.50	10.30	5.90	7.7
Butylenes, liq. vol. per cent chg.	2.20	4.00	5.50	1.80	5.70	....	5.60	4.70	2.00	4.1
Pentylenes, liq. vol. per cent chg.	....	....	....	....	....	....	....	....	....	....
n-Butane, liq. vol. per cent chg.	*0.70	0.16	0.38	*1.70	1.31	....	1.76	*4.60	*2.40	2.0
i-Butane, liq. vol. per cent chg.	....	0.84	0.81	....	0.98	....	1.22	....	....	0.8
C_3 polymers, vol. per cent chg.	4.36	7.10	8.20	3.30	6.21	....	5.15	6.22	3.58	4.6
C_4 polymers, vol. per cent chg.	1.52	2.78	3.80	1.25	3.95	....	3.89	3.26	1.39	2.1
Total polymers, vol. per cent chg.	5.88	9.88	12.00	4.64	10.17	....	9.04	9.48	4.97	7.1
C_3 alkylate, vol. per cent chg.	7.49	12.20	14.15	5.80	10.70	....	8.81	10.70	6.13	8.1
C_4 alkylate, vol. per cent chg.	2.90	5.44	7.48	2.45	7.75	....	7.60	6.40	2.72	5.1

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Improvement of Octane Rating of Gasoline by Isomerization

*by A. V. Frost**

Abstract

This article deals with the thermodynamics of catalytic isomerization of hydrocarbons and is limited to isomerization of paraffins from butane to octane and of cyclohexane to methylcyclopentane. Data on equilibrium constants of isomerization, entropies and octane numbers of these hydrocarbons, reported in the literature as well as those calculated by the author are correlated. The effect of the temperature at which the equilibrium in isomerization was attained on the octane number of the mixture and the significance of gem-substituted hydrocarbons are graphically shown. Calculation of the octane numbers of the equilibrium mixtures of paraffins showed that with rise of the isomerization temperature these octane numbers suffer a drop which is the more pronounced the higher is the molecular weight of the paraffin. In order to obtain by isomerization a saturated gasoline with an octane number exceeding 70, a temperature lower than 177° C. should be used, if the reaction is carried out in the presence of a catalyst incapable of formation of gem-substituted compounds, but if the catalyst can form such compounds, temperature of 200°-300° C. may be used.

OCTANE numbers of straightrun gasolines are, as a rule, connected with their contents of branched-chain paraffins. The higher is the content of isoparaffins, the higher is the octane number of the gasoline, pure as well as after addition of antiknock agents. Data obtained in investigation of straight-run gasolines[2] revealed that the content of straight-chain paraffins in them is quite high and that the octane numbers of the gasolines are the higher, the lower is the content of paraffins with straight chains. In a number of studies,[1,3,4,4] it was established that the effect of catalysts of the type of aluminum chloride consists in partial conversion of straight-chain paraffins into isoparaffins.

The published research is yet insufficient for designing a commercial process of isomerization of paraffinic gasolines of petroleum origin, as well as synthetic gasoline (synthin). So far, the possibility of isomerizing paraffins has been established only in principle. The catalysts and conditions under which industrial isomerization should be carried out for the purpose of raising the octane numbers of gasolines have to be determined experimentally. Isomerization reactions do not proceed to completion. They are reversible processes. Isomerization converts the hydrocarbon mixture until a definite equilibrium is reached, depending upon the temperature.

In order to facilitate the work on isomerization of gasolines, conditions under which isomerization processes can occur are outlined in the series of articles offered. This outline is prepared from the point of view of thermodynamics, and indicates the ultimate octane numbers, determined by the contents of branched-chain hydrocarbons which are attainable at the temperatures considered. Knowledge of these values will be helpful to the research worker in attempting to avoid the fruitless search for catalysts to be employed under conditions under which isomerization can proceed to only a slight extent.

The first calculations of the equilibria of isomerizations of hydrocarbons for a large number of samples

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The facts and opinions in the translations and abstracts presented in this survey are solely those of the authors cited in the references. Universal Oil Products Co. does not necessarily endorse the statements made.

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This is a translation of the original article, by J. G. Tolpin, Universal Oil Products Co., under auspices of the Petroleum Division, American Chemical Society.

TABLE 1—EQUILIBRIUM CONSTANTS OF ISOMERIZATION OF BUTANES, PENTANES, HEPTANES AND CYCLOHEXANE

	C_4H_{10} normal ⟷ iso		Normal pentane to		Normal hexane to				Cyclohexane to methyl cyclopentane
°K	I	II	Isopentane	Neo-pentane	2-Methyl-pentane	3-Methyl-pentane	2,2-Dimethyl-butane	2,3-Dimethyl-butane	
298.1	5.6	5.0	6.3	17.1	5.34	1.88	62.6	4.05	0.195
300	5.5	4.9	6.2	16.5	5.2	1.86	62	4.0	0.20
400	2.34	2.1	3.4	2.30	2.71	1.24	10.0	1.51	0.95
450	1.74	1.6	2.8	1.26	2.22	1.09	5.4	1.09	1.82
500	1.38	1.25	2.45	0.74	1.88	0.96	3.30	0.84	2.8
600	0.98	0.92	1.86	0.37	1.45	0.82	1.58	0.56	5.5
800	0.63	0.62	1.48	0.15	1.08	0.70	0.69	0.37	12
1,000	0.49	0.48	1.26	0.09	0.89	0.65	0.43	0.29	....

Note: I. Data of the present authors; II. Data of Rossini et al.[15]

TABLE 2—EQUILIBRIUM CONSTANTS OF ISOMERIZATION OF NORMAL HEPTANE

									Oct. No. of mixture	
°K	2-Methyl-hexane	3-Methyl-hexane	3-Ethyl-pentane	2,2-Di-methyl-pentane	2,3-Di-methyl-pentane	2,4-Di-methyl-pentane	3,3-Di-methyl-pentane	2,2,3-Tri-methyl butane	All isomers	Without gem derivatives
298.1	7.52	6.18	0.49	33.7	29.9	9.96	11.2	11.5	85	76
400	3.68	3.87	0.40	4.73	9.57	2.46	3.16	2.09	78	68
450	2.87	3.32	0.36	2.58	6.34	1.53	1.94	1.17	71	64
500	2.40	2.94	0.33	1.53	4.71	1.09	1.37	0.74	69	63
600	1.77	2.36	0.29	0.74	2.88	0.60	0.80	0.36	63	57
800	1.24	1.85	0.25	0.31	1.55	0.30	0.43	0.17	56	51
1,000	1.06	1.67	0.23	0.19	1.07	0.21	0.31	0.11	52	47

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were carried out by Ewell.[6] However, due to the lack of precision of the values and the assumptions on which Ewell's calculations are based, his data are at considerable variance with those obtained in direct investigation of equilibria in isomerization of saturated hydrocarbons carried out for butane,[1,4,7] pentane[1,7] and hexanes,[7] as well as with data obtained by calculations based on thermal effects and spectroscopical values available now for butanes, pentanes, hexanes and heptanes.[8-12] From thermal data obtained by very precise determinations, calculations based on the Nernst theorem, as well as from spectroscopical data, Rossini, Prosen and Pitzer[13] computed equilibrium constants of isomerization of butanes, pentanes, hexanes and heptanes, the results of which are quoted in Tables 1 and 2. Data for isomerization of normal butane to isobutane and of normal pentane to isopentane given in Table 1 were corrected by the present author on the basis of direct determination of equilibria, similarly to what was done by the present author[10] for the calculations of Pitzer[5] relating to isomerization of normal butane to isobutane. The equilibrium constants are uniformly expressed as the ratio of the concentration of the corresponding isomer to that of the normal hydrocarbon. The values calculated by Rossini et al[13] were shown by them to well agree with the experimental data for butanes, pentanes and hexanes obtained in the previously published works,[1-7] as well as in new studies not yet published.

In this work, the isomerization equilibrium constants for normal octane were determined by the following approximate method: for hydrocarbons from butanes to heptanes, these constants are expressed for the interval from 298.1 to 600° K by the equation

$$\log K_p = \frac{A}{T} + B \qquad (1)$$

The values of A and B are shown in Table 3, from which it follows that the values of B practically coincide with those calculated from the change of entropy in isomerization, as computed by Pitzer and Scott[11] on the basis of spectroscopical data, by dividing them by 2.302 × R = 4.575. Since the values of ΔS for isomerization of octanes are well known from the work of Pitzer and Scott,[11] the value of B for octanes can easily be found with an error not exceeding 0.05 ± 0.08. The so calculated values are shown in Table 4.

Heat of Isomerization

Concerning the values of A, which are determined by the average heat of isomerization, unknown for octanes, this cannot be so easily determined. Correlation of the data available for the hydrocarbons with from 4 to 7 carbon atoms made it possible to determine the heat of isomerization and in this way the values of A only for 2-methyl, 2,2-dimethyl and 3-methyl derivatives (the average error in the value of A is ±17) on the basis of the agreement of the values of A for the above-mentioned compounds among isomers of heptane and hexane.

It may be assumed that the heats of isomerization to 3-ethyl and 3,3-dimethyl derivatives will be found identical for heptane and octane. In addition, the following assumptions were made: (1) The heats of isomerization of normal octane to 3-methylheptane and 4-methylheptane are identical. (2) The heats of isomerization of normal heptane and normal octane into 2,3-dimethyl derivatives are identical. (3) The heat of isomerization of normal heptane into 2,4-dimethylpentane is equal to that of isomerization of normal octane to 2,5-dimethylhexane. (4) The heats of isomerization of normal octane into 2,4-dimethylhexane and 2,3-dimethylhexane are equal. (5) The heat of isomerization of normal octane to: (a) 3,4-dimethylhexane is the sum

TABLE 3—ENTROPIES OF ISOMERIZATION ($\Delta S_{298.1}$) OF HYDROCARBONS ACCORDING TO PITZER AND SCOTT,[11] HEATS OF ISOMERIZATION,[13,33,34] VALUES OF A AND B AND OCTANE NUMBERS[17] OF HYDROCARBONS FROM BUTANE TO HEPTANE INCLUSIVE

Hydrocarbon—	$-\Delta S_{298.1}$	$-\Delta S/4.575$	$-B$	A	$-\Delta H_0$	$-\Delta H_{298.1}$	Octane No.
Normal butane	0.0	0.00	0.000				92
Isobutane	3.7	0.81	0.757	449	1,740	2,110	99
Normal pentane	0.0	0.00	0.000				61
Isopentane	1.3	0.28	0.190	289	940	1,450	89
Neopentane	10.1	2.21	2.27	1,062	4,040	4,670	83
Normal hexane	0.0	0.00	0.000				25
2-Methylpentane	2.3	0.50	0.395	334	1,108	1,748	73
3-Methylpentane	2.4	0.52	0.440	213	399	1,069	75
2,2-Dimethylbutane	6.7	1.46	1.395	956	3,535	4,375	96
2,3-Dimethylbutane	5.9	1.29	1.106	514	1,856	2,546	95
Normal heptane	0.0	0.00	0.000				0
2-Methylhexane	2.0	0.44	0.382	378	1,210	1,800	45
3-Methylhexane	0.2	0.04	0.004	237	—420	1,180	(45)
3-Ethylpentane	3.2	0.70	0.818	168	—480	1,520	(45)
2,2-Dimethylpentane	8.1	1.77	1.764	978	3,400	4,450	93
2,3-Dimethylpentane	2.7	0.59	0.560	613	1,710	2,800	89
2,4-Dimethylpentane	6.8	1.49	1.447	735	2,320	3,400	82
3,3-Dimethylpentane	5.9	1.29	1.249	692	2,230	3,240	84
2,2,3-Trimethylbutane	9.2	2.01	1.886	880	3,020	4,170	101

TABLE 4—ENTROPIES OF ISOMERIZATION ($\Delta S_{298.1}$) OF NORMAL OCTANE TO ISOMERIC OCTANES,[11] VALUES OF A AND B AND OCTANE NUMBERS OF ISOMERS OF OCTANE[17]

Hydrocarbon—	$-\Delta S_{298.1}$	$-\Delta S/4.575 = B$	A	Oct. No.
Normal octane	0.0	0.00	0	—17
2-Methylheptane	2.1	0.46	356++	(35)
3-Methylheptane	0.6	0.13	225++	35
4-Methylheptane	2.1	0.46	225	(35)
3-Ethylhexane	1.4	0.31	170+	(35)
2,2-Dimethylhexane	7.8	1.71	970++	(76)
2,3-Dimethylhexane	4.8	1.05	610	76
2,4-Dimethylhexane	4.4	0.96	610	(76)
2,5-Dimethylhexane	6.0	1.31	735	52
3,3-Dimethylhexane	6.2	1.36	690+	(76)
3,4-Dimethylhexane	6.5	1.42	450	85
2-Methyl-3-ethylpentane	5.5	1.20	525	91
3-Methyl-3-ethylpentane	7.4	1.62	645	(76)
2,2,3-Trimethylpentane	9.3	2.03	1,200	102
2,2,4-Trimethylpentane	9.3	2.03	1,325	100
2,3,3-Trimethylpentane	7.8	1.71	1,045	97
2,3,4-Trimethylpentane	7.9	1.73	935	(100)
2,2,3,3-Tetramethylbutane	16.6	3.63	1,940	103

TABLE 5—EQUILIBRIUM CONSTANTS OF ISOMERIZATION OF NORMAL OCTANE TO ISOOCTANE

°K	2-Methylheptane	3-Methylheptane	4-Methylheptane	3-Ethylhexane	2,2-Dimethylhexane	2,3-Dimethylhexane	2,4-Dimethylhexane	2,5-Dimethylhexane	3,3-Dimethylhexane	3,4-Dimethylhexane	2-Methyl-3-ethylpentane	3-Methyl-3-ethylpentane	2,2,3-Trimethylpentane	2,2,4-Trimethylpentane	2,3,3-Trimethylpentane	2,3,4-Trimethylpentane	2,2,3,3-Tetramethylbutane	Oct. No. of mixture: All isomers	Oct. No. of mixture: Without gem derivatives
300	5.4	4.2	1.95	1.82	33	9.5	11.8	13.8	8.7	1.20	3.5	3.4	93	245	55	24.5	550	100	72
400	2.7	2.7	1.26	1.29	5.1	3.0	3.6	3.4	2.3	0.50	1.29	0.98	9.3	19.1	7.9	4.1	16.6	87	62
500	1.78	2.2	0.98	1.07	1.70	1.45	1.82	1.45	1.05	0.30	0.71	0.47	2.3	4.2	2.4	1.74	1.78	75	56
600	1.35	1.78	0.83	0.93	0.81	0.93	1.15	0.81	0.62	0.22	0.48	0.29	0.93	1.51	1.07	0.68	0.40	66	51

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of the heats of isomerization to 3-methylheptane and to 4-methylheptane; (b) 2-methyl-3-ethylpentane is the sum of the heats of isomerization into 2-methylheptane and 3-ethylhexane; (c) 2,2,3-trimethylpentane is composed of the heats of isomerization to 2,2-dimethylhexane and 3-methylheptane; (d) 2,2,4-trimethylpentane is composed of the corresponding values for 2,2-dimethylhexane and 2-methylheptane; (e) 2,3,4-trimethylpentane is composed of the corresponding values for 2, 3 and 4-methylheptanes; (f) 2,2,3,3-tetramethylbutane consists of the double value of the heat of isomerization into 2,2-dimethylhexane; (g) 2,3,3-trimethylpentane is defined as the sum of the corresponding values for 2-methylheptane and 3,3-dimethylhexane; (h) 3-methyl-3-ethylpentane is composed of the heat of isomerization to 3-ethylhexane, 3-methylheptane and 250 × 4.575 (based on the comparison of the heats of isomerization, or the value of A, to 2-methylheptane and 3-methylheptane with that for 2,2-dimethylhexane and 3,3-dimethylhexane).

The values of A calculated on the basis of these data are shown in Table 3.

From the data of Table 4, isomeri-

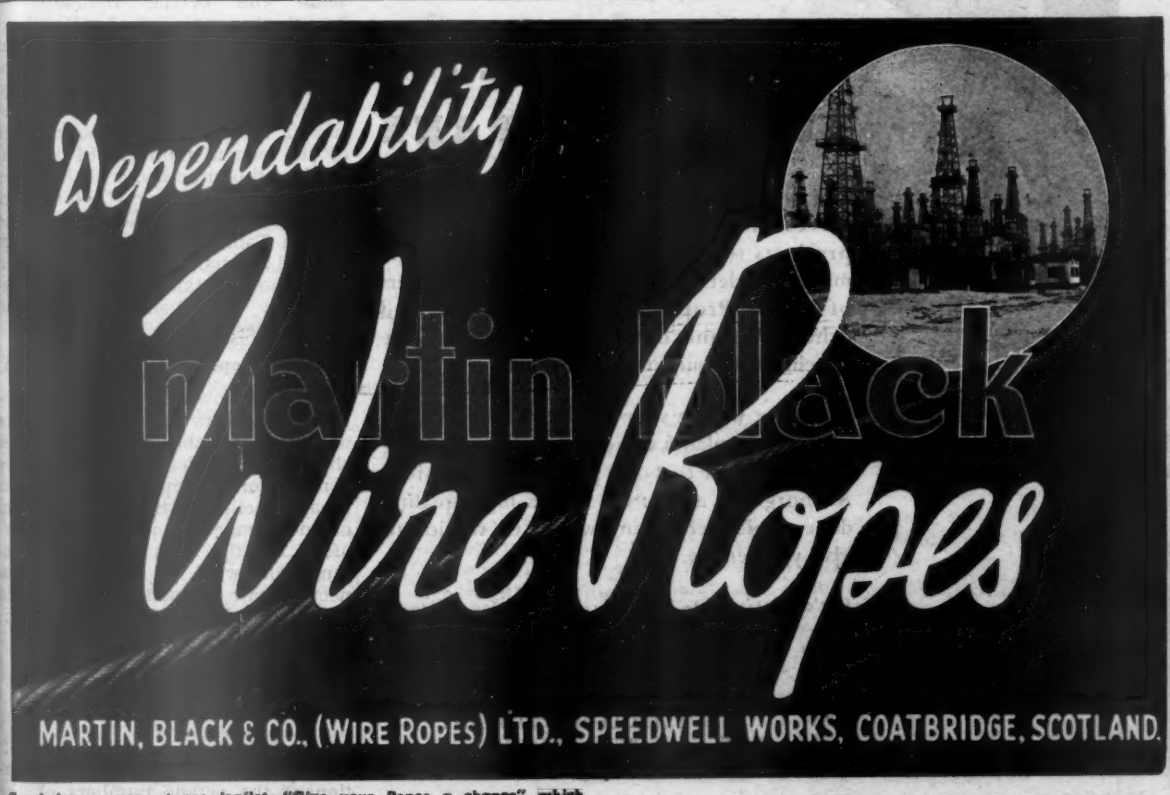
TABLE 6

°C.	Equilibrium percentage of methylcyclopentane in the liquid mixture	Liquid: K_p = Methylcyclopentane / Cyclohexane	Liquid: log K_p	Vapor, log K_p
20	...	0.125	—0.906	—0.760[7]
25	12.5	0.143	—0.844	—0.704[10]
35	14.5	0.170	—0.770	—0.634[10]
45	16.2	0.193	—0.714	—0.583[10]
55	19.2	0.238	—0.624	—0.497[10]
65	21.4	0.272	—0.566	—0.443[10]
77.4	25.6	0.344	—0.463	—0.345[10]
80	...	0.299	—0.524	—0.403[7]
110	...	0.538	—0.268	—0.183[7]
140	...	0.908	—0.041	+0.038[7]

TABLE 7—CORRELATION OF OCTANE NUMBERS OF EQUILIBRIUM MIXTURES OF ISOMERIC HYDROCARBONS FROM BUTANE THROUGH OCTANES

°K	°C.	Octane number of the equilibrium mixture of all isomers: Butane	Pentane	Hexane	Heptane	Octane	Cyclohexane and methylcyclopentane*	Oct. No. of equilibrium mixture containing no gem derivatives: Pentane	Hexane	Heptane	Octane	Oct. No. of gasolines: I†	II†
300	27	98	83	93	85	100	78	85	76	76	72	90	77
400	127	97	83	86	76	87	80	83	71	68	62	83	71
450	177	96	82	82	72	80	80	82	69	64	58	79	68
500	227	96	81	79	69	75	81	81	67	62	56	76	66
600	327	95	80	73	63	66	81	79	64	57	51	70	63
800	527	95	78	67	56	..	82	78	61	51	..	..	..
1,000	727	94	77	64	52	..	..	77	59	47	..	..	..

*The octane number of methylcyclopentane is 82, that of cyclohexane 77.[11] †Mixture containing 25 per cent each of the equilibrium mixtures of pentanes, hexanes, heptanes and octanes: I—all isomers, II—isomers exclusive of gem derivatives.



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zation equilibrium constants for normal octane were calculated shown in Table 5.

Equilibrium Constants

Isomerization equilibrium constants for cyclohexane to methylcyclopentane may be determined from the work of Glasebrook and Lovell,[18] Schuit et al[7] and Nikolaeva and Puchkov.[19] The first two refer to the liquid phase, and the calculation for the gaseous phase was carried out on the basis of vapor pressures of methylcyclopentane and cyclohexane at 72°

$$\left[\log\left(\frac{\text{pressure methylcyclopentane}}{\text{pressure cyclohexane}}\right) = \frac{760}{577} = 0.12\right]$$

, dependence of the ratio of the vapor pressures of these hydrocarbons upon temperatures found on the basis of Trouton law:

$$\log\frac{\text{pressure methylcyclopentane}}{\text{pressure cyclohexane}} = \frac{1}{4.575}\left(\frac{200^*}{T} - 0.03\right)$$

. This is done on

*22 × (81 — 72) ≈ 200.

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the assumption that Raoul's law applies to mixtures of methylcyclopentane with cyclohexane. The results of the calculations are shown in Table 6.

On the basis of the analysis of the products formed by heating cyclohexane and methylcyclopentane under hydrogen pressure in the presence of molybdenum sulfide, as reported by Puchkov and Nikolaeva[19] the isomerization-equilibrium constant at 400° is found to amount to

$$K'_p{}^{400} = \frac{\text{cyclohexane}}{\text{methylcyclopentane}} = \text{from}$$

0.040/0.620 to 0.060/0.620, or from 0.064 to 0.097 = 0.080 ± 0.023. $K_p{}^{400} = \frac{\text{methylcyclopentane}}{\text{cyclohexane}} = 12.5 \pm 3.7$.

These data satisfy the equation:

$$\log K_p = \log\frac{\text{methylcyclopentane}}{\text{cyclohexane}} = \frac{-860}{T} + 2.17 \pm 0.10$$

The octane numbers for the different hydrocarbons were very precisely determined by Smittenberg and coworkers by the CFR motor method,[27] and their data are quoted in Tables 3 and 4. The other values needed were calculated by analogy. Thus, the octane numbers of 3-methylhexane and 4-methylhexane were taken to be equal to that of 2-methylhexane. The octane numbers of dimethylhexanes and of 3-methyl-3-ethylpentane were assumed to be equal to the average of the octane numbers of the investigated hydrocarbons of this type. For all untested trimethylpentanes the octane number was taken to be 100. In Tables 3 and 4, the ratings derived by analogy are distinguished from those obtained by direct experiment by their inclusion in parentheses.

Octane Depends on Composition

It was shown by the same research workers[17] that in mixtures of paraffins the octane number shows a linear dependence upon the composition of the mixture. This greatly facilitates the calculation of octane numbers of mixtures of paraffins. On the basis of this, the octane number of the mixture is connected with the octane numbers of the components (O.N.)i as follows:

$$\text{Octane number of the mixture} = \frac{\Sigma K_{pi}(\text{O.N.})_i}{\Sigma K_{pi}}$$

with the aid of which the calculation of the octane numbers of the equilibrium mixtures of isomeric

hydrocarbons was carried out; the results are shown in Table 7 and Fig. 1.

Since isomerization over catalysts of the type of aluminum chloride forms no compounds with quaternary carbon atoms (gem substitutes), octane numbers were also calculated for mixtures in which all isomers are in equilibrium with exception of those containing quaternary carbon atoms (Table 5 and Fig. 2). In addition, octane numbers of gasolines were computed consisting of equal amounts of pentanes, hexanes, heptanes and octanes, the isomers of which are in equilibrium (Fig. 3).

The table and the figures reveal that octane numbers of equilibrium mixtures of paraffins decrease with rise of the temperature the more

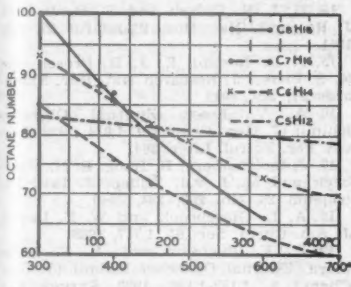

Fig. 1: Dependence of the octane numbers of equilibrium mixtures of isomers of pentane, hexane, heptane and octane upon the temperature at which the equilibrium was attained

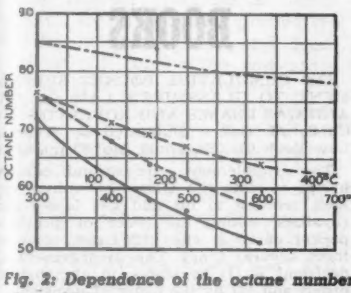

Fig. 2: Dependence of the octane numbers of equilibrium mixtures of isomers of pentane, hexane, heptane and octane containing no gem derivatives, upon the temperature at which the equilibrium was attained. Designations as in Fig. 1

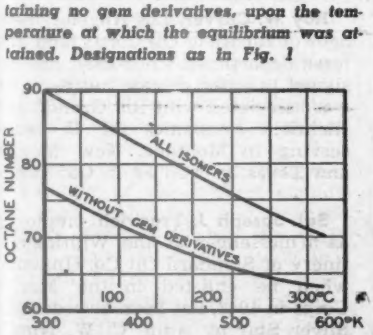

Fig. 3: Dependence of the octane number of gasoline containing equal amounts of isomers of pentanes, hexanes, heptanes and octanes upon the temperature at which the equilibrium was attained.

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rapidly, the higher is the molecular weight of the hydrocarbon. For the mixture of methylcyclopentane with cyclohexane, the octane numbers of which are close, practically no change of the octane number with temperature occurs.

The presence of hydrocarbons with quaternary carbon atoms greatly affects the octane number of the equilibrium mixture of hydrocarbons. It follows from the calculations cited that: (a) When isomerization catalysts are used incapable of forming gem-substituted paraffins, preparation of saturated gasoline with octane number exceeding 70, by isomerization of a low octane charge, should be carried out at temperatures below 177°, approaching room temperature; (b) catalysts capable of formation of gem-substituted paraffins may be employed in preparation of gasolines with octane numbers exceeding 70 also at temperatures of 200°-300°.

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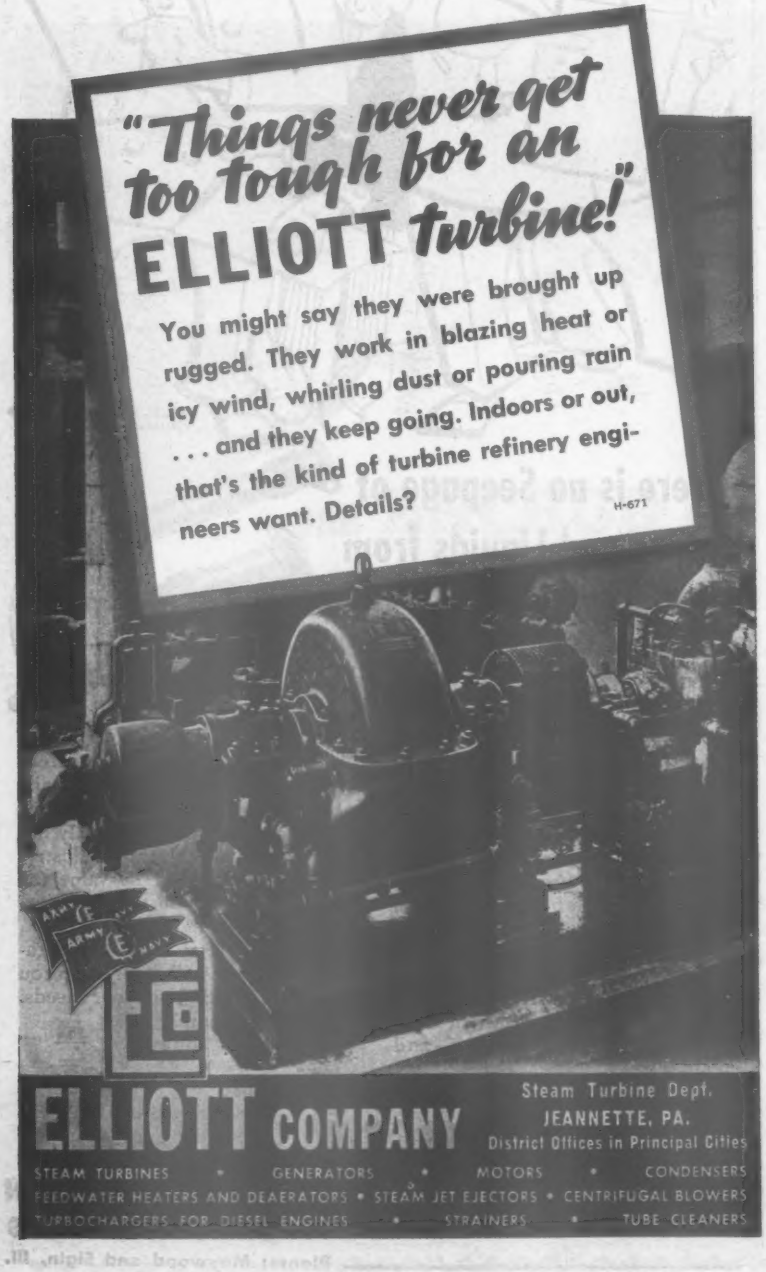
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BOOKS

1943 CUMULATIVE POCKET SUPPLEMENT TO GLASSMIRE'S LAW OF OIL AND GAS LEASES AND ROYALTIES. By Curtis M. Oakes. Published by Thomas Law Book Co., St. Louis, Mo. 80 pp. $3.50.

This supplement, the second edition, brings to date the Glassmire volume on laws relating to oil and gas leases and royalties, taking the place of previous pocket parts. It cites 723 cases, some of them several times. The arrangement of decisions is (1) by states, in alphabetical order, and (2) by the order of decision.

Roy W. Carver, Los Angeles, manager of Richfield Oil Corp., land and lease department since 1937, has resigned to enter private business. He was associated with Rio Grande and Richfield companies for 15 years, serving in Montana, New Mexico and Texas as well as in California.

Sgt. Joseph J. Trgovich, employed as a messenger at the Whiting refinery of Standard Oil Co. (Indiana) when he enlisted in the Marine Corps in 1942, has been awarded the Silver Star by Adm. C. W. Nimitz "somewhere in the Pacific," for "coolness, tireless energy, fearless devotion to duty and extraordinary example." He has been serving as a member of a scout sniper platoon.

Santa Maria Plant

(Continued from page 147)

the top of the rich-oil fractionator. Table 3 gives the analyses and rates of the rich-oil-fractionator vapor and the raw-gasoline-accumulator vapor. From these analyses it is computed that 86 per cent of the methane and 71 per cent of the ethane are removed from the system by the rich-oil fractionator. The vapor from the top of the rich-oil fractionator is commingled with the interstage untreated gas at 70 lb. pressure and is compressed and recycled through the absorbers. A heater, condenser, accumulator and pumps are not required for this unit and its operation is very simple. At some future date it can be readily converted to a pressure still in order to produce propane liquid, by installing a 100-lb. condenser and accumulator. In which case, a small portion of the raw-gasoline production from the low-pressure-stripping still would be used as reflux for the high-pressure still and the remainder of the raw-gasoline production from the low-pressure-stripping still would be circulated through the 100-lb.-pressure condenser to serve as an absorbing medium for the desired propane. The stabilizer would then be fed from the 100-lb. accumulator.

The rich oil from the bottom of the rich-oil fractionator flows through steam-heated preheaters into the main stripping and fractionating still where the raw-gasoline fractions are removed from the absorption oil. The fractionating-stripping still is 60 in. in diameter and 55 ft. high. It has 19 perforated trays, 13 of which are above the feed inlet. A water draw-off tray is located immediately below the seventh tray from the top, leaving six trays between the feed inlet and the water-drawoff tray. The still also has built-in oil reheaters located below the feed inlet. One is located between the second and third tray from the bottom and another is located below the bottom tray. It was realized that the heaters in this still are not ideally located, the optimum location being about two trays down from the feed. However, the cost of changing the location of the heaters would have been prohibitive and it was therefore decided to use the still "as is." Exhaust steam at 50-lb. gage from the lean-oil pumps is metered into the bottom section of still and rises upward through the perforations of the trays in order to strip all of the raw-gasoline fractions from the oil. The still operates at 45-lb. gage with a bottom temperature of 350° F. and a top temperature of 170° F. The top temperature is maintained automatically by a temperature controller which regulates the amount of raw or stable gasoline used as reflux to the top of the still. The bottom section of the still provides surge capacity for the system and the level at this point varies according to the amount of oil in the system.

The hot lean oil from the bottom of the fractionating-stripping still flows through the shell side of the interchangers to the lean-oil pumps which raise the pressure to 250 lb. so that it will flow through the lean-oil coolers and into the absorbers, thereby completing the oil cycle.

The raw-gasoline production together with the still reflux leave the top of the still in vapor form and are then condensed in cooling units located in the cooling tower and finally are accumulated as a liquid in the raw-gasoline surge tank at 40-lb. gage and about 65° F. The raw-gasoline production is then pumped into the stabilizer at 200 lb. where the normal butane and heavier fractions are separated from the remainder of the raw gasoline by fractionation and are produced as stabilized gasoline from the bottom of the column. This product at Santa Maria has a Reid vapor pressure of about 30 lb. at 100° F. The isobutane content of the raw gasoline is required by alkylation plants in the refineries for the production of avi-

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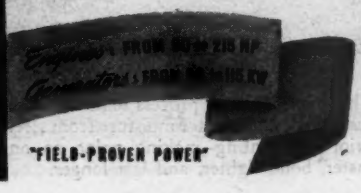


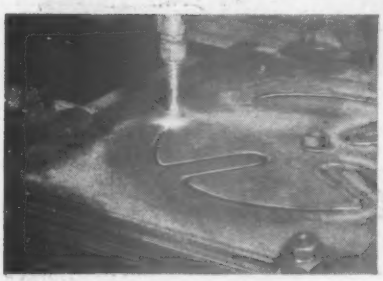
LINDE METHODS AND EQUIPMENT

Help to Maintain Production and to Lower Operating Costs

Oxy-acetylene processes are used throughout industry to speed up production and construction programs, to conserve materials, to lower operating costs, and to simplify maintenance and repair. Some of the many oxy-acetylene applications are outlined here.

OXY-ACETYLENE WELDING

The oxy-acetylene flame makes possible the joining of practically any metals—like or unlike—so that the weld is as strong as the base metals themselves. *Welded piping systems* in plants and refineries use less fittings, occupy less space, and remain leakproof indefinitely. Overland *pipe line welding* by Linde's steel-welding process produces strong, ductile welds in pipe of any size. *Bronze-welding* and resurfacing speed the repair of worn or broken parts and hard-facing with HAYNES STELLITE alloys makes parts subjected to abrasion, heat, or corrosion last from two to twenty-five times longer.

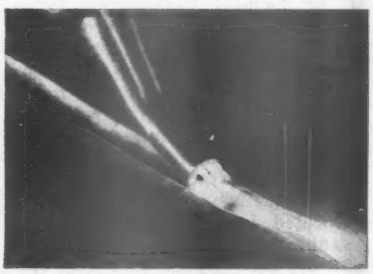


MACHINE FLAME-CUTTING

Shape-cutting with OXWELD machines quickly produces simple or intricate steel shapes with clean-cut edges that usually require no machining. Identical parts can be cut rapidly, from tightly clamped piles of plate by this method.

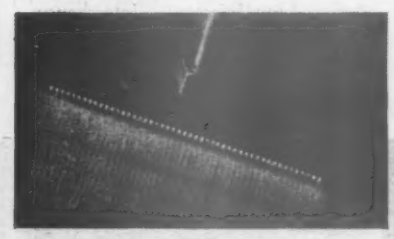
HAND-CUTTING

Flame-cutting with manually operated blowpipes is useful for cutting pipe in the fabrication of piping systems. Hand-cutting also is used to cut structural steel in construction or alteration work—to reclaim old pipe—and to cut scrap to length.



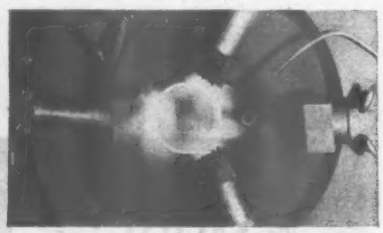
GOUGING

With OXWELD hand-cutting blowpipes equipped with gouging nozzles, a groove of surface metal—such as faulty or temporary welds—can be removed quickly, without need of grinding or chipping, and without harm to the adjacent areas.



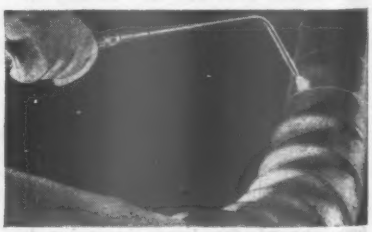
FLAME-PRIMING

This relatively new process removes loose scale, rust, and surface moisture from steel prior to painting—making paint go on faster, bond tighter, and last longer.



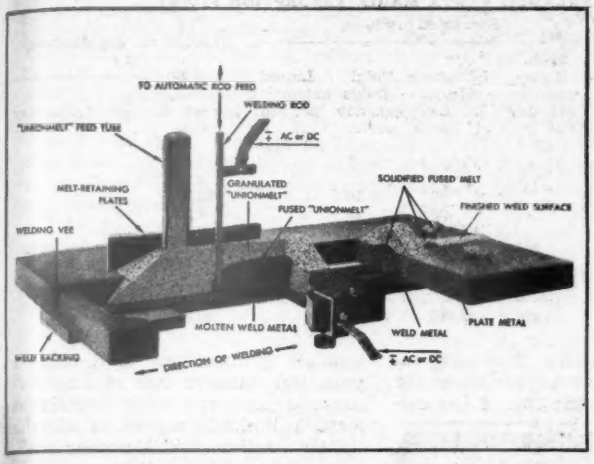
FLAME-HARDENING

This oxy-acetylene process is used to impart a hard, wear-resistant case to steel and iron parts without affecting the toughness of the core.

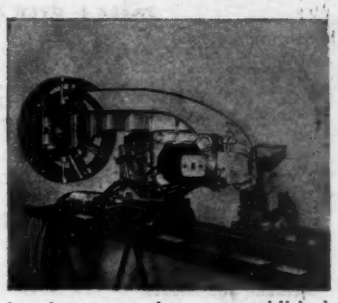


WRINKLE-BENDING

The intensely hot, easily controlled oxy-acetylene flame facilitates wrinkle-bending of pipe and provides a smooth, long-sweep bend, without thinning the pipe walls.

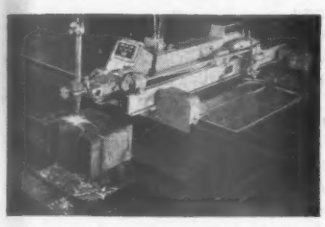


This sketch shows how a UNIONMELT butt weld is made.



UNIONMELT WELDING

UNIONMELT electric welding is a unique automatic process that makes welds of unusually high quality in any thickness of metal at high speeds. Once the speed and current values are established by the operator, the "human element" is eliminated as a factor in producing good welds. UNIONMELT welding is done under a protective blanket of a special granulated material—without flash, glare, or sparks. The rod is fed automatically as work progresses and is thoroughly mixed with the molten base metal. For these reasons, UNIONMELT welding is widely used in the fabrication of pressure vessels, pipe, railroad equipment, tankers, and ships.

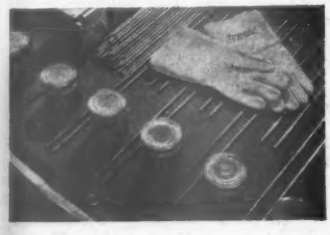


MACHINE APPARATUS

Included in the OXWELD line of apparatus are portable and stationary oxy-acetylene machines for cutting shapes or straight lines; flame-hardening apparatus; bar and billet cut-off machines; automatic welding equipment; and tractor units for plate-edge preparation.

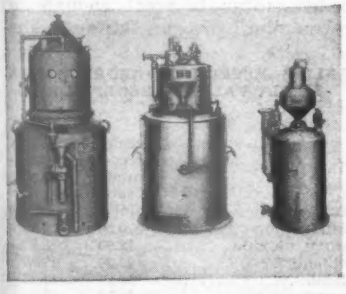
HAND APPARATUS

Oxy-acetylene apparatus which may be ordered from Linde includes oxy-acetylene blowpipes for all welding and heating work; oxy-acetylene cutting blowpipes, cutting attachments, and nozzles; and oxy-acetylene descaling and flame-priming equipment. OXWELD apparatus is supplied from Linde offices and warehouses. The PUROX and PREST-O-WELD line, and PREST-O-LITE air-acetylene appliances for soldering and brazing, are distributed by industrial and automotive jobbers.



WELDING RODS AND SUPPLIES

The many kinds and sizes of OXWELD high quality welding rods make it possible to select the one that will give best results on each job. The OXWELD line also includes fluxes, gloves, goggles, lighters, hose, and asbestos paper. Rods and supplies may be ordered from Linde or from automotive and industrial jobbers.



GENERATORS AND MANIFOLDS

OXWELD acetylene generators are made for both portable and stationary use — with maximum generating capacities of from 30 to 9,000 cu. ft. per hour. OXWELD manifolds centralize the oxygen and acetylene supply from cylinders.

OXYGEN, ACETYLENE, CARBIDE

A booklet describing use of LINDE oxygen, PREST-O-LITE acetylene, UNION carbide, and OXWELD apparatus in these and other processes will be sent without charge on request. Ask for Form 5268A.

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TABLE 2—OVER-ALL PLANT COMMODITY BALANCE, SANTA MARIA ABSORPTION PLANT

Component—	18,000 M.c.f./day intake gas			Extracted products				17,280 M.c.f./day discharge gas		
	Gas vol. per cent	Gal./M.c.f.	Gal./day	29-lb. R.v.p. gasoline gal./day	Isobutane side cut gal./day	Total liquids gal./day	Liquid extraction per cent	Gas vol. per cent	Gal./M.c.f.	Gal./day
Hydrogen sulfide (gr./100 C.F.)	25	.....	.....	.....	.....	.....	.....	0.00	.....	.....
Water vapor	0.30	.....	.....	.....	.....	.....	.....	.05	.....	.....
Air	1.00	.....	.....	.....	.....	.....	.....	1.00	.....	.....
Carbon dioxide	8.80	.....	.....	.....	.....	.....	.....	9.20	.....	.....
Methane	79.83	.....	.....	.....	10	10	.....	83.10	.....	.....
Ethane	3.87	.....	.....	.....	25	25	.....	4.02	.....	.....
Propane	3.19	.....	.....	.....	1,120	1,120	.....	2.48	.....	.....
Isobutane	0.51	0.167	3,006	240	2,166	2,406	80.0	0.11	0.035	600
n-Butane	1.22	0.383	6,894	6,200	524	6,724	97.5	0.03	0.010	170
Pentane and heavier	1.28	0.500	9,000	8,930	.....	8,930	99.2	0.01	0.004	70
Total	100.00			15,370	3,845	19,215		100.00		

ation gasoline. It is therefore produced as a liquid along with some normal butane and propane as a side cut from the column. This side cut liquid is withdrawn from about the sixth tray from the top of the column. It is impossible to produce a pure isobutane in this manner because a side cut must contain at least a limited amount of all the lighter fractions which appear overhead. However, a satisfactory concentration of the desired product can often be obtained in this manner.

The removal of hydrogen sulfide from the Santa Maria gas constitutes a major problem. The hydrogen sulfide can be completely removed by means of iron oxide beds which convert the hydrogen sulfide to ferric sulfide; then oxygen, which must be present in the gas for this process to function, converts the ferric sulfide back to iron oxide and deposits free sulfide in the bed. In actual practice the iron oxide bed consists of wood shavings impregnated with ferric oxide, thus leaving a large proportion of the bed volume void to receive the deposited sulfur. The equations for this process are as follows:

(1) $Fe_2O_3 + 3H_2S \rightarrow Fe_2S_3 + 3H_2O$
(2) $2Fe_2S_3 + 3O_2 \rightarrow 2Fe_2O_3 + 6S$

If the humidity and temperature of the gas are properly controlled the reactions indicated by Equations 1 and 2 will continue simultaneously until the amount of deposited sulfur is great enough to prevent the hydrogen sulfide in the

TABLE 3—RECYCLED VAPORS, SANTA MARIA VALLEY ABSORPTION PLANT

Analysis:	Rich oil fractionator vapors (Mol %)	Raw gasoline accumulator vapors (Mol %)
Water vapor	0.50	0.50
Carbon dioxide	12.60	5.80
Methane	49.64	17.50
Ethane	12.64	11.23
Propane	20.72	36.13
Isobutane	1.40	9.38
n-Butane	1.93	15.75
Pentanes and heavier	0.57	3.71
	100.00	100.00
Gallonage content:	—Gal./M.c.f.—	
Isobutane	0.456	3.055
n-Butane	0.607	4.954
Pentanes and heavier	0.207	1.349
Gas rate, M.c.f./day	610	280
Recycled gallonage:	—Gal./day—	
Isobutane	278	855
n-Butane	370	1,390
Pentanes and heavier	126	378

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gas from contacting the ferric oxide. Past experience indicates that a bed will continue to function until about 20 to 25 lb. of sulfur have been deposited per cubic foot of total bed volume. The bed must then be cleaned out and recharged. This process is very expensive in cases in which the hydrogen sulfide content of the gas is high.

The soda ash process is commonly used where the amount of hydrogen sulfide to be removed is great. However, the soda ash process usually will not completely remove all of the hydrogen sulfide and must therefore be followed by an iron oxide bed. The soda-ash process is greatly complicated by the presence of CO_2 in the gas as is indicated by the following equations:

$$(1)\quad \underset{\text{Soda Ash}}{Na_2CO_3} + \underset{\text{Hydrogen Sulfide}}{H_2S} \rightarrow \underset{\text{Sodium Hydrosulfide}}{NaHS} + \underset{\text{Sodium Bicarbonate}}{NaHCO_3}$$

$$(2)\quad \underset{\text{Soda Ash}}{Na_2CO_3} + \underset{\text{Carbon Dioxide}}{Co_2} + \underset{\text{Water}}{H_2O} \rightarrow \underset{\text{Sodium Bicarbonate}}{2NaHCO_3}$$

These reactions are reversible and according to the law of mass action a high carbon-dioxide content of the gas causes a high sodium bicarbonate concentration as indicated by Equation 2, moving from left to right. The high sodium bicarbonate concentration resulting from Equation 2 shifts the reaction equilibrium of Equation 1 from right to left, thereby reducing the removal of the hydrogen sulfide from the gas.

The soda ash units at Santa Maria were found to perform according to this theory. The 8 per cent carbon dioxide content of the Santa Maria gas converts about 99 per cent of the 4 per cent soda-ash solution to bicarbonate. Nevertheless with this mixture about 70 per cent of the hydrogen sulfide is removed from the gas.

The soda-ash process provided at Santa Maria consists of pumping a 4 per cent soda-ash solution to the top of two parallel 8-in. diameter contactors or absorbers, each containing six perforated trays. The contactors operate on the cooled compressor interstage gas at about 70 lb. gage, and a solution-to-gas ratio of about 35 gal. per standard 1,000 cu. ft. is employed. The solution from the bottom of the contactors flows through liquid level controllers to an areator where Equation 1 is reversed by spraying the solution into a rising current of air, so as to remove the hydrogen sulfide from the field of action and discharge it from the top of the areator. A conventional forced-draft cooling tower with a 50-ft.-high extended-discharge stack is employed as the areator and sufficient air is blown through the areator to dilute the hydrogen sulfide to below the toxic danger limit. Equation 2 is theoretically also reversible in the areator. Practically, however, the reaction rate of Equation 2 from right to left is very slow. Consequently the percentage conversion of carbonate to bicarbonate is predominantly a function of the equilibrium conditions in the contactors, and very little carbon dioxide is removed from the gas after the process has been in operation a short time.

There are certain features of the processes and the construction of the Santa Maria Valley absorption plant which are different from an ideal plant which would be constructed if the required materials and equipment were available. For example, direct-fired heat of the absorption oil is superior to steam heat. Also, absorbers with 20 or more trays instead of 15 are advantageous. However, in spite of these limitations the fact remains that the plant was successfully constructed and put into operation under adverse conditions and is adding its share of production to the war effort.

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These are photographs of our new analytical and control laboratories where "we read water." Scores of water samples received daily are given careful and complete analyses under the most modern methods of determinations by graduate chemists. Our application of Chrom Glucosates to scale and corrosion control in cooling systems, boiler and water systems has brought such a response that it has necessitated these larger analytical laboratory facilities. Take advantage of these completely equipped laboratories and our highly trained staff to find the answer to your problems in scale, corrosion and algae.

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1. Where samples are received, assigned numbers and recorded.
2. East bank of laboratory walls at analytical and control laboratory.
3. One side of the supply department showing a portion of the stock of basic chemicals required in making up testing reagents.
4. Balance and Microscope Room.
5. Where H-O-H Test Kits are assembled and sent to clients.

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QUESTIONS on TECHNOLOGY

by W. L. Nelson

Fischer-Tropsch Process For Natural Gas

This will have reference to an inquiry concerning the Fischer-Tropsch process for the conversion of natural gas into gasoline. If you have any general information relative to per cent conversion, steam requirements, operating pressures, and installation cost, etc., I would appreciate your directing me to such data.—M. L. R.

Exactly what is meant by the Fischer-Tropsch process is not entirely clear because these scientists have made so many studies and there are so many different ways to conduct their processes that just what should be contemplated is doubtful. An excellent summary of the production of hydrocarbons from carbon monoxide is given in Chapter 52 of Carleton Ellis' book entitled, "Petroleum Derivatives, Vol. 2, pages 1,223-1,255, 1937, Reinhold Publishing Corp., and this reference should be consulted. Somewhat more information on the properties of the products is given in Vol. 4 of Science of Petroleum, by Dunstan and others, Oxford University Press, pages 2,448 and 2,660. Finally, a somewhat recent discussion with some cost data was presented by A. H. Nissan in the July 21 (page 49) and July 28 (page 89), 1938, issues of The Oil and Gas Journal.

Although recent German practice is not available, it is believed that much of the motor fuel being used by the Germans is made by synthesis from carbon monoxide and hydrogen. However, coal is the starting material rather than natural gas. Ellis states in his 1937 edition that the German production of motor fuel at that time was probably one-seventh as much as the United States consumption of gasoline.

If our reserves of crude oil should suddenly become low, the Fischer-Tropsch or similar processes would undoubtedly be of great usefulness. At the present time and until that distant future when crude oil is no longer available, such processes cannot be considered. According to Nissan's paper referred to above, which appears to be the most recent cost data available, the cost of plants is large compared with the cost of refineries and the operating costs amount to 10 cents or more per gallon. The total cost of gasoline at the refinery is given as larger than 20 cents per gallon.

The process consists of four major steps or operations. The first three of these are common to nearly all types of plants but the fourth or synthesizing operation permits many alternatives.

1. Production of carbon monoxide and hydrogen gas mixture by the water gas or similar reactions.

$$C + H_2O = CO + H_2$$

$$CH_4 + H_2O = CO + 3H_2$$

2. Removal of hydrogen sulfide or acidic materials.

3. Removal of organic sulfur to avoid poisoning of catalysts.

4. Synthesis into hydrocarbons, alcohols, oxygen compounds, etc., as desired by using different catalysts and operating conditions. These operations are shown in the accompanying flow diagram.

If hydrocarbons are desired the synthesis is conducted at low pressures, atmospheric or lower, at temperatures of 160°-300° C. (320°-572° F.) and in the presence of cobalt-type as a catalyst. The reaction, which may be indicated as shown below, is highly exothermic.

$$xCO + 2xH_2 = (CH_2)x + xH_2O$$

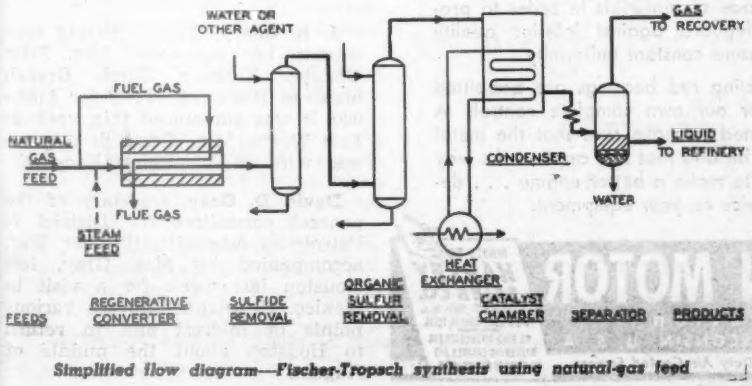
$$+ 48x \text{ k-cal.}$$

Although this equation indicates nothing but olefin formation, saturated paraffin hydrocarbons are also produced particularly if additional hydrogen is fed into the process.

The reaction to carbon monoxide and hydrogen is usually fairly complete. Thus the yield of gas mixture obtained may approach 400 or more per cent. In other words, the amount of gas mixture produced may amount to four or more times as much as the natural gas used. The yield of liquid product that can be produced from the gas mixture is greatly dependent on the gas composition but yields of 1 to 2 gal. of oil per 1,000 cu. ft. of gas mixture are common. The oil composition is stated by F. Fischer (Oel, Kohle, Erdoel, Teer, 11, 782, 1935) for commercial operations, to be:

	Per cent by weight
Gasoline (boiling below 86° F.)	8
Gasoline (86°-257° F.)	37
Gasoline (257°-392° F.)	25
Lamp and diesel oil	24
Paraffin wax (melting 122°-212° F.)	2
Paraffin wax (melting 212° and up)	4

The high olefin content that is possible by proper control of the process, permits the production of synthetic lubricating oils or similar materials. The lubricating oils may be produced by polymerization of a 302°-392° F. fraction, or by chlorination followed by attachment of aromatic rings in place of the chlorine.



Simplified flow diagram—Fischer-Tropsch synthesis using natural-gas feed

Viscosity-Gravity Constant

What is the viscosity-gravity constant and what is its relation to the base of the oil?—S.G.K.

The viscosity-gravity constant, first proposed by Hill & Coats (Ind. Eng. Chem. 20, 641, 1928), is used to a limited extent in judging the chemical composition and physical properties of petroleum oils. Mathematically this constant is defined as:-

$$A = \frac{10G - 1.0752 \log (V-38)}{G - \log (V-38)}$$

in which:

G = specific gravity at 60° F.

V = viscosity, S.U.S. at 100° F.

Perhaps this confusing equation is in part responsible for the lack of popularity of the constant. The viscosity-gravity constant has been

TABLE 1—VISCOSITY-GRAVITY CONSTANTS OF BASES OF CRUDE OILS

	V.G.C.	Charac. factor	Vis. index	Aniline points, °C.
Paraffin base	.8 -.82	12.2-12.5	90-100	110-130
Mixed base	.82-.85	11.8-12	65- 85	94-110
Naphthene base	.85-.9	11.0-11.5	0- 55	70- 90

used mainly in describing lubricating-oil products, particularly in differentiating between true paraffin base oils and solvent refined oils which have a high viscosity-index but do not have the high specific gravity of the paraffin base oils.

The viscosity-gravity constant of paraffin base oils is low and for naphthene-base products is high. Approximate values of the constants are shown in Table 1. Characterization factors, aniline points and viscosity-indexes are also shown for purposes of comparison.

The same kind of information is given in Ind. Eng. Chem. Vol. 20, page 642, June 1928 as:

	V.G.C.
Penn. crude	.8067
Mid-Continent	.8367
Gulf Coast No. 1	.8635
Gulf Coast No. 2	.8845
Gulf Coast No. 3	.9025

Even more specific information is given by Houghton & Robb in Ind. Eng. Chem., Anal. Ed. Vol. 3, page 144 (1931) concerning the constants of particular crude oils as shown in Table 2.

A small amount of information is given in Gruse & Stevens, Chemical

TABLE 2—VISCOSITY-GRAVITY CONSTANTS OF OILS FROM VARIOUS CRUDE OILS

	V.G.C.
Sour Lake, Texas	.916
Heavy Mexican	.894
Sunset, Calif.	.885
Light Mexican	.860
Van Zandt County, Texas	.852
Seminole, Okla.	.844
Reagan County, Texas	.839
Salt Creek, Wyo.	.829
Burbank, Okla.	.828
Ranger, Texas	.827
Eureka, Pa.	.804
Buckeye, Ohio	.800
Milltown, Pa.	.800

Technology of Petroleum (McGraw-Hill Book Co., 1942) relating cetane number, characterization factor and v.g.c.—

Cetene No.	V.G.C.	Charac. factor
30	.93	10.8
70	.81	12.2

Temperature of Crude Storage Tanks

In figuring losses from crude storage tanks, is the temperature in the tank the same as the weather temperature?—A.I.F.

In making such computations, it may be assumed that the liquid (surface) temperature is about 4.5 per cent higher than the recorded weather temperature. Average data of C. C. Ashley, given in "Evaporation Losses of Petroleum Oils From Steel Tanks," A.P.I. meeting Chicago, November 18, 1938, are

Ave. atmos. temp. °F.	Ave. oil temp. °F.	Oil temperatures min.	Oil temperatures max.
40	41.5	..	..
50	53.2	..	..
60	62.9	60	75
70	73.6	..	..
80	84.3	80	90
90	95.1	88	95
100	107.0	..	..

Obviously, these temperatures apply to exposed, not buried, tanks. In some computations it is wise to be conservative and for these situations Chicago Bridge & Iron Works suggests:

PROBABLE MAXIMUM LIQUID SURFACE TEMPERATURES

	°F.
Gulf Coast	100
Mid-Continent	115
Chicago area	100
Atlantic seaboard	100
Pacific Coast	95

For tanks that breathe the maximum variation in temperature is of greater significance than the tank temperature. Louis Bosa in "Venting Requirements for Low-Pressure Oil Storage Tanks," The Oil and Gas Journal, November 18, 1938, page 196, discusses temperature variations and among other recommendations suggests:

	°F.
Pacific Coast	20
Great Lakes	25
Atlantic Coast	30
Salt Lake	30
Mid-Continent	40
Rocky Mountain	40
Mexico	40
Gulf Coast	50

The temperature in buried tanks is nearly uniform throughout the year.

In designing vent valves, lines, etc., the rate of temperature change is also important. The temperature in the vapor space is thought to drop at the rate of about 1° F. per minute under worst conditions, i.e. a thundershower in the summer.

J. R. Sharp, Tulsa, drilling contractor, has purchased Mrs. Ruth Goggins Eldson's Dutch Branch home at Benbrook, Tex., for $135,000, it was announced this week in Fort Worth. Mrs. Eldson is the former wife of Col. Elliott Roosevelt.

David D. Gray, secretary of the general committee for District 3, Petroleum Administration for War, accompanied by Mrs. Gray, left Houston last week for a visit in Mexico. He planned to see various points of interest and to return to Houston about the middle of August.

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Engineering Fundamentals No. 145

A FEATURE OF THE OIL AND GAS JOURNAL

PURPOSES OF CEMENTING

THE principal purpose of oil-well cementing is to exclude water from the oil-producing formations. The most common type of cementing operation consists of excluding water overlying the oil zone. This is accomplished by forcing cement slurry into the annular space between the casing and the walls of the well, and allowing it to set and form a permanent barrier to the downward movement of top water.

There are several different mechanical methods by which this placement of cement behind casing may be accomplished. These methods will be diagrammed and described later in this series. Selection of the most suitable cementing method must be based on the conditions existing in the particular well, upon legal requirements, and upon expected future changes. In describing the various methods, an effort will be made to point out sets of conditions under which each method is most usefully applied.

Other Cement Functions

There are several other functions served by the cement, some of which are:

1. Reinforcement of casing against collapse by external pressure.
2. Protection of casing from contact with corrosive formation water.
3. Prevention of migration of fluids from one stratum to another behind the pipe.
4. Reinforcement of casing when shooting a well with nitroglycerin.
5. Prevention of gas blowouts from high-pressure zones behind casing.
6. Protection from pollution of fresh water zones behind the casing.
7. Conservation of oil and gas in shallow strata behind the casing.
8. Protection of oil string when larger strings are pulled from cable-tool wells.

Placement of cement in wells using high-pressure "squeeze" methods has been developed to the point that it may serve many special purposes, some of which are:

1. Reduction of gas production by squeezing cement into a gas-producing horizon exposed below the production string of casing in a well.
2. Reduction in, or exclusion of, water production closely associated with the oil.
3. Plugging leaks in casing.
4. Recementing around casing shoe.
5. Filling caverns or porous passages to prevent loss of drilling mud from a rotary well.

Basic Procedure

The basic procedure in all cementing methods consists of mixing dry cement with fresh water in such proportions that it can be easily pumped, as a fluid, through casing or tubing to the intended position in a well.

Equipment used in oil well cementing may be divided into two general groups; e.g., surface equipment and subsurface equipment. The surface equipment consists essentially of that used for transportation, pumping, mixing and measuring. This equipment is essentially the same regardless of the type of cementing job being performed. The subsurface equipment used in cementing varies considerably from one type of job to another.

Surface equipment used in cementing may be either steam driven or gasoline-motor driven. The steam-driven equipment depends upon obtaining steam at a well to drive the cement pumps; while in the motor-driven type, the pumps are driven by a power takeoff from the truck motor and by an auxiliary gasoline motor.

A measuring device is a very important piece of cementing equipment since it indicates instantly and continuously at the surface the depth of the top of the cement slurry below the surface and thus makes it easy to properly control the placement of the cement.

Operation of Equipment

The equipment commonly used for mixing sacked cement is illustrated diagrammatically in Fig. 1. A mixing pump discharges water through line A and out of nozzle E under high velocity. At the same time, paper bags of cement are laid on the table B, dragged across a knife C, and the cement dumped into the hopper D. The high-velocity jet of water at E sucks the dry cement into the pipe and discharges the mixture at F into a mixing vat G. The turbulence of the discharge stream from the base of the mixing hopper is sufficient to give a uniformly mixed slurry in the vat G. At the same time, the operator can observe the consistency and other properties of the slurry in the vat G. Another pump picks up the mixed slurry through suction line H and forces it into the well.

Subsurface equipment used in connection with various types of cementing operations will be discussed later.

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1. Halliburton Oil Well Cementing Co., Trade Literature.
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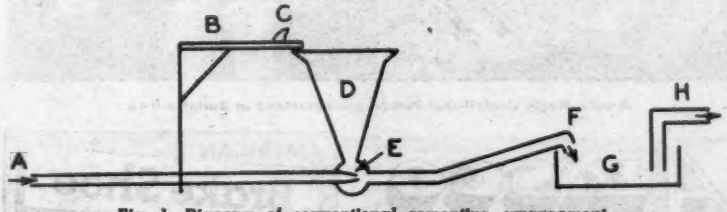

Fig. 1: Diagram of conventional cementing arrangement

Series prepared by Glenn M. Stearns, associate professor of petroleum engineering, University of Oklahoma

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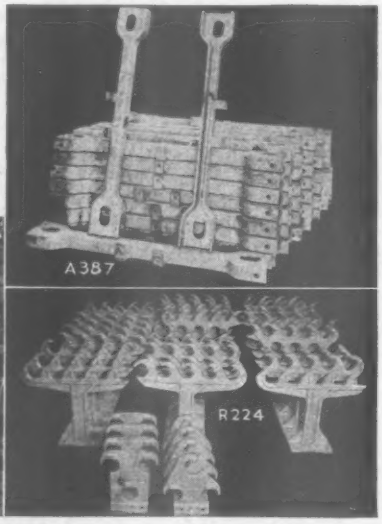
Ask for Bulletin No. 108 on Amsco Alloy.



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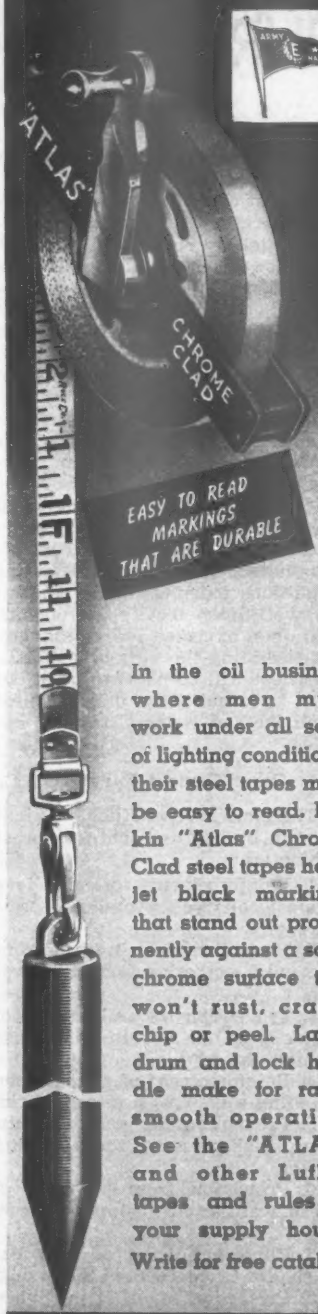

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A WEEKLY FEATURE OF THE OIL AND GAS JOURNAL

Evaporation Losses

THE loss of crude oil as a vapor from storage is dependent on the following factors:

1. Vapor-pressure or tendency to evaporate.

2. Temperature—vapor pressure increases rapidly with temperature.

3. Variation of temperature—expansion and contraction forces gas through the relief vents.

4. White paint or insulation keeps temperature from changing.

5. Kind of tank — fixed, flexible or balloon roofs. Also floating roofs and water displacement tanks which have no vapor space.

6. Filling frequency — complete filling displaces one full tank of vapor.

7. Windage provides fresh air to be saturated with oil vapor.

Vapor pressure affects tank losses only because it affects the purity of the vapor. Thus, if the oil has a high vapor-pressure (10-14 lb.) the vapor above the oil will be nearly 100 per cent pure, whereas the vapor space above a low-vapor-pressure oil will be filled with air or a very dilute vapor.

Temperature changes cause the vapor mixture to expand or contract and the tank breathes oil vapor out upon expansion and breathes fresh air in when it cools. Increasing temperature also increases the vapor pressure causing even more vapor to be vented from the tank and vice versa.

Kind of tank.—Fixed-roof tanks cannot change in volume and hence breathing and filling losses are great. Flexible roofs, balloon roofs, or chambers and gas holders connected to the tanks permit some expansion and contraction and thus may eliminate some or all losses depending on the completeness of the setup. Completely sealed storage such as floating roofs, adequate balloons, and water-displacement tanks may eliminate nearly all losses including filling losses. Chicago Bridge & Iron Works compares losses and costs of welded storage as shown in Table 1.

Yearly costs of crude-oil evaporation are shown in Fig. 1. It is used by estimating or counting the number of times the tank is filled per year. Read across the figure to the kind of tank that is installed or being considered and read the yearly cost on the proper scale at the bottom. Thus at 10 fillings per year, a regular fixed-roof 50,000-bbl. crude-oil tank will lose vapor valued at $4,000 (center scale) each year. Furthermore, a floating-roof construction would lose only $2,600 worth of vapor per year.

The figure is based on data of Chicago Bridge & Iron Works (Bull. 20, page G-3) and can only be approximate because of variations in climate, crude oils, and installations.

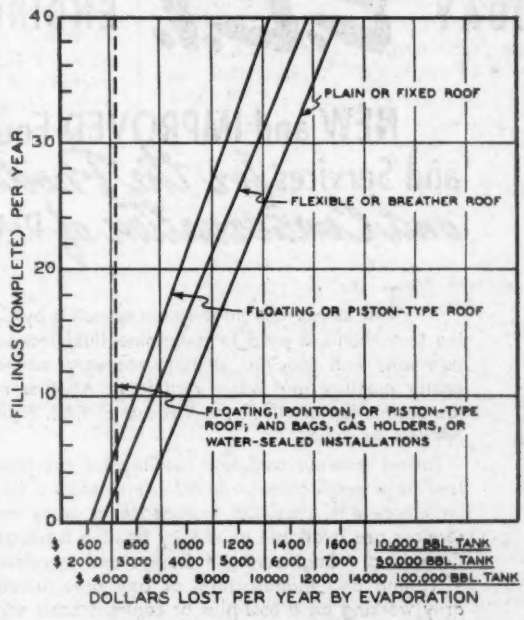

FILLINGS (COMPLETE) PER YEAR
0
10
20
30
40
PLAIN OR FIXED ROOF
FLEXIBLE OR BREATHER ROOF
FLOATING OR PISTON-TYPE ROOF
FLOATING, PONTOON, OR PISTON-TYPE ROOF; AND BAGS, GAS HOLDERS, OR WATER-SEALED INSTALLATIONS
$ 600 800 1000 1200 1400 1600 10,000 BBL. TANK
$ 2000 3000 4000 5000 6000 7000 50,000 BBL. TANK
$ 4000 6000 8000 10000 12000 14000 100,000 BBL. TANK
DOLLARS LOST PER YEAR BY EVAPORATION

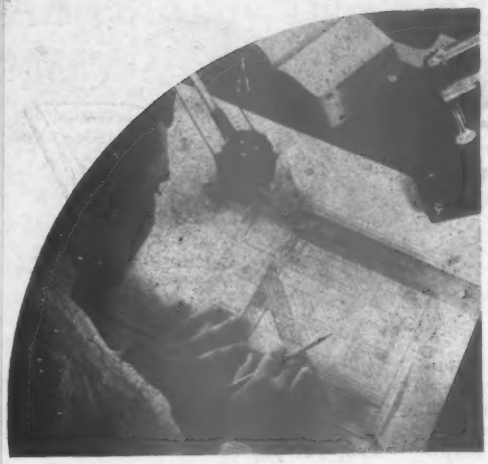
Fig. 1: Crude storage evaporation costs per year

TABLE 1—TOTAL EVAPORATION LOSS FROM CRUDE-OIL STORAGE TANKS

Tank data		Total evaporation loss, in 42-gal. barrels							
		Gastight fixed roof		Wiggins Breather roof		Wiggins Balloon roof		Wiggins Pontoon roof	
Capacity in barrels (42 U. S. gal.)	Diameter in feet	One filling	Annual breathing	One filling	Annual breathing	One filling	Annual breathing	One filling	Annual breathing
10,000	42.5	10	150	...	...	9	0	0	42
20,000	60.0	20	290	20	140	18	0	0	80
30,000	73.5	30	420	30	186	27	0	0	114
40,000	85.0	40	540	40	220	36	0	0	140
50,000	95.0	50	650	50	230	45	0	0	160
60,000	104.0	60	750	60	240	54	0	0	180
70,000	112.5	70	840	70	245	63	0	0	196
80,000	120.0	80	920	80	240	72	0	0	208
100,000	134.0	100	1,110	100	200	90	0	0	250

One filling = one complete filling.

No. 2 in a series by W. L. Nelson, professor of petroleum refinery engineering, University of Tulsa



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No. 6—Heat Transfer Film Coefficient—Water Being Cooled

by Paul Buthod and B. W. Whiteley

This article discusses the calculation of film coefficients for water being cooled on the inside of pipes and explains how an equivalent heat-transfer diameter may be worked out for water flowing in annular areas such as in double pipe exchangers. A chart for the graphical determination of thermal resistance is presented. In solution of one of the two examples given, step-by-step procedure is carried out in determining the sizes of a practical heat-exchanger installation.

A FEW years ago, calculations and design of heat exchange equipment were commonly based on an over-all coefficient of heat transfer. This, in effect, treated all obstructions to the flow of heat as a single barrier. Since, in general, several thermal resistances exist in any heat-exchange system and since these resistances are highly dependent on such factors as velocity, thermal properties of the fluid, etc., it is not surprising that the use of over-all heat transfer coefficients often led to inaccurate results.

Probably the greatest improvements in the design of heating equipment came from studies of these individual film resistances and correlation of these studies with actual equipment performance data. Calculation of individual film coefficients are usually based on a rational equation which takes into consideration all of the various complex factors affecting the flow of heat. One of the most common fluids used in heat-exchange systems is water. Calculation of the film coefficient for water being cooled on the inside of a pipe is based on the Dittus-Boelter equation:

$$(1)\quad h = 0.0225\,\frac{k}{d}\left(\frac{dV}{z}\right)^{0.8}\left(\frac{Cz}{k}\right)^{0.3}$$

where the symbols are explained in the accompanying notation.

After computing the several resistances, both on the inside and outside of the tube as well as the metal wall resistance, the amount of heat transferred is calculated from the basic rate equation:

$$(2)\quad q = U\,A\,\Delta t = \frac{A\,\Delta t}{R_i + R_o + R_s \ldots}$$

From the foregoing equation, it will be noted that the over-all coefficient of heat transfer is equal to the reciprocal of the sum of the several resistances, or:

$$U = \frac{1}{R_i + R_o + R_s \ldots}$$

Since the outside surface area of a tube or pipe is different from the inside area, it is necessary to correct the individual resistances in such a manner that they are all expressed in terms of the same area of heat transfer. It is usually common practice to correct the outside film resistance and metal wall resistance to equivalent resistances, based on the inside area of the pipe or tube. These corrections may be made by application of the following rules:

1. Multiply the thermal resistance of the outside film by the ratio D_i/D_o, where D_i is the inside pipe diameter and D_o is the outside pipe diameter.

2. Multiply the thermal resistance of the metal wall by D_i/D_{av}, where D_{av} is the average pipe diameter or $(D_i + D_o)/2$.

3. Since the inside film resistance is already based on the inside area of the pipe, it is unnecessary to apply a correction factor to this quantity.

For calculation of the thermal resistance of the fluid film in the case of water being cooled, the accompanying chart (Fig. 1) can be used. To use this chart, it is necessary to know the mass velocity, pipe diameter, and average water temperature. The value of "R," the thermal resistance can then be determined graphically.

Although, the chart is based on the Dittus-Boelter equation for water flowing on the inside of pipes, it may also be used for water flowing through the annular areas in double-pipe heat exchangers. In this case, an equivalent heat transfer diameter is used on the chart in place of the actual pipe inside diameter, or:

$$D' = (D_i^2 - D_s^2)/D_s$$

where D′ is the equivalent diameter to be used in place of the actual pipe inside diameter on the chart. D_i is inside diameter of the outer pipe and D_s is the outside diameter of the inner pipe.

The use of the accompanying chart is illustrated by the following examples:

Example 1.—Water is being cooled in a 2-in. pipe. The mass velocity is 1,000,000 lb./hr.-sq. ft. The average water temperature is 80° F. Find the thermal resistance and film coefficient for the water film.

Solution.—This example is solved by referring to the chart marked, "Heat Transfer Film Coefficient—Water Being Cooled."

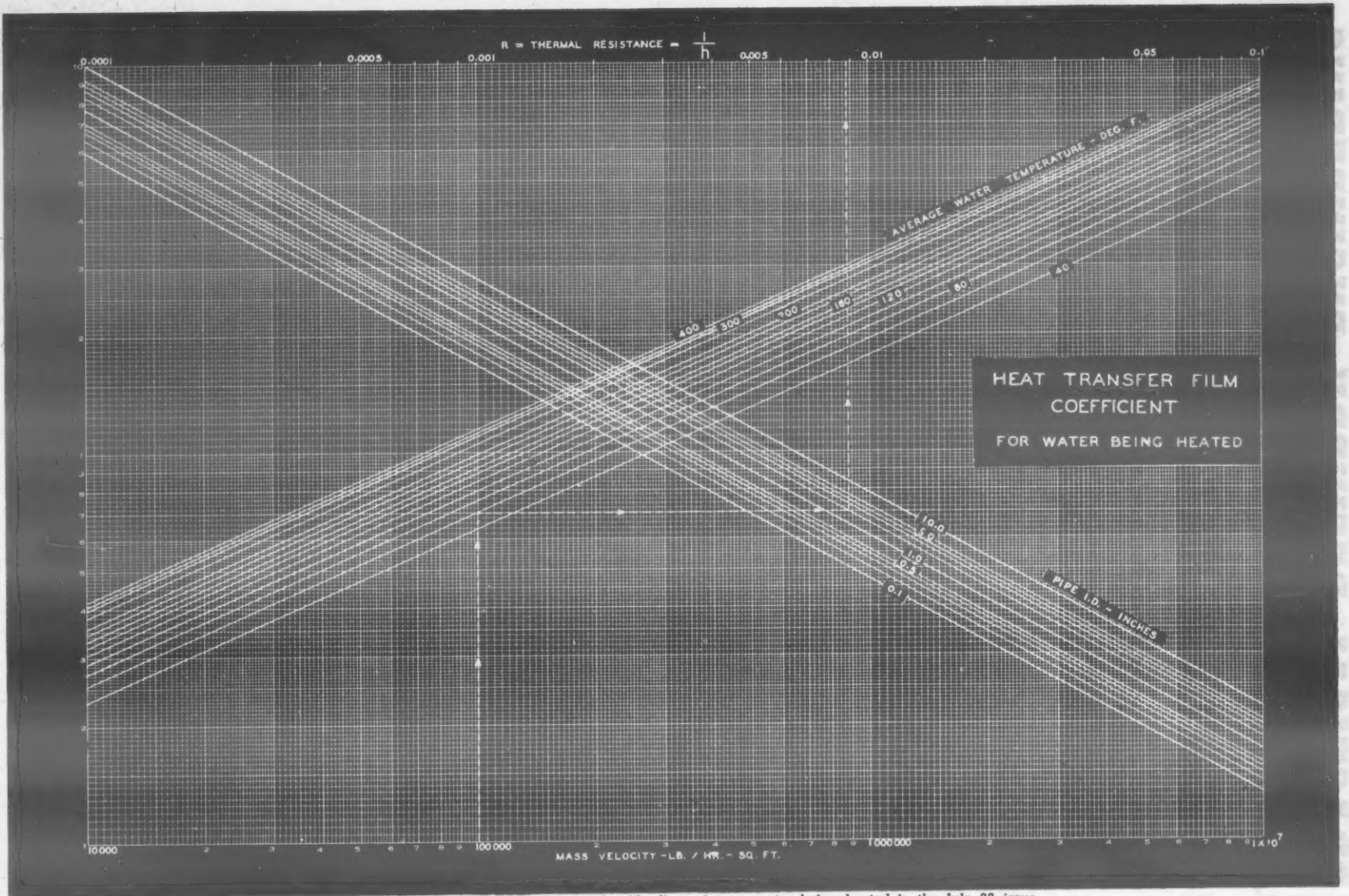
Starting at a mass velocity of 1,000,000 at the bottom of the chart, rise vertically to a water temperature of 80° F., then move horizontally to a pipe inside diameter line of 2 in. From this point, rise vertically to the top scale and read "R = 0.00147." The film coefficient is the reciprocal of "R," or:

$$h = 1/R = 0.00147$$

$$= 680 \text{ B.t.u./hr.-sq. ft.-°F.}$$

Example 2.—A pipe-line station is to install a heat exchanger to cool the engine circulating water, using oil from the pipe line as a cooling agent. It is proposed to use a double-pipe heat exchanger consisting of 2-in. standard pipe inside 3-in. standard pipe. The water is to flow through the 2-in. pipe at the rate of 1,000 gal. per hour. The water enters the exchanger at 150° F. and is to be cooled to 130° F.

The oil is to pass through the annular space between the pipes and at a rate of 1,000 gal. per hour, countercurrent to the water flow. The oil is available at 65° F. and by a heat balance, the outlet oil temperature is



This figure should have appeared with discussion on water being heated in the July 22 issue

This figure should have appeared with discussion on water being heated in the July 22 issue

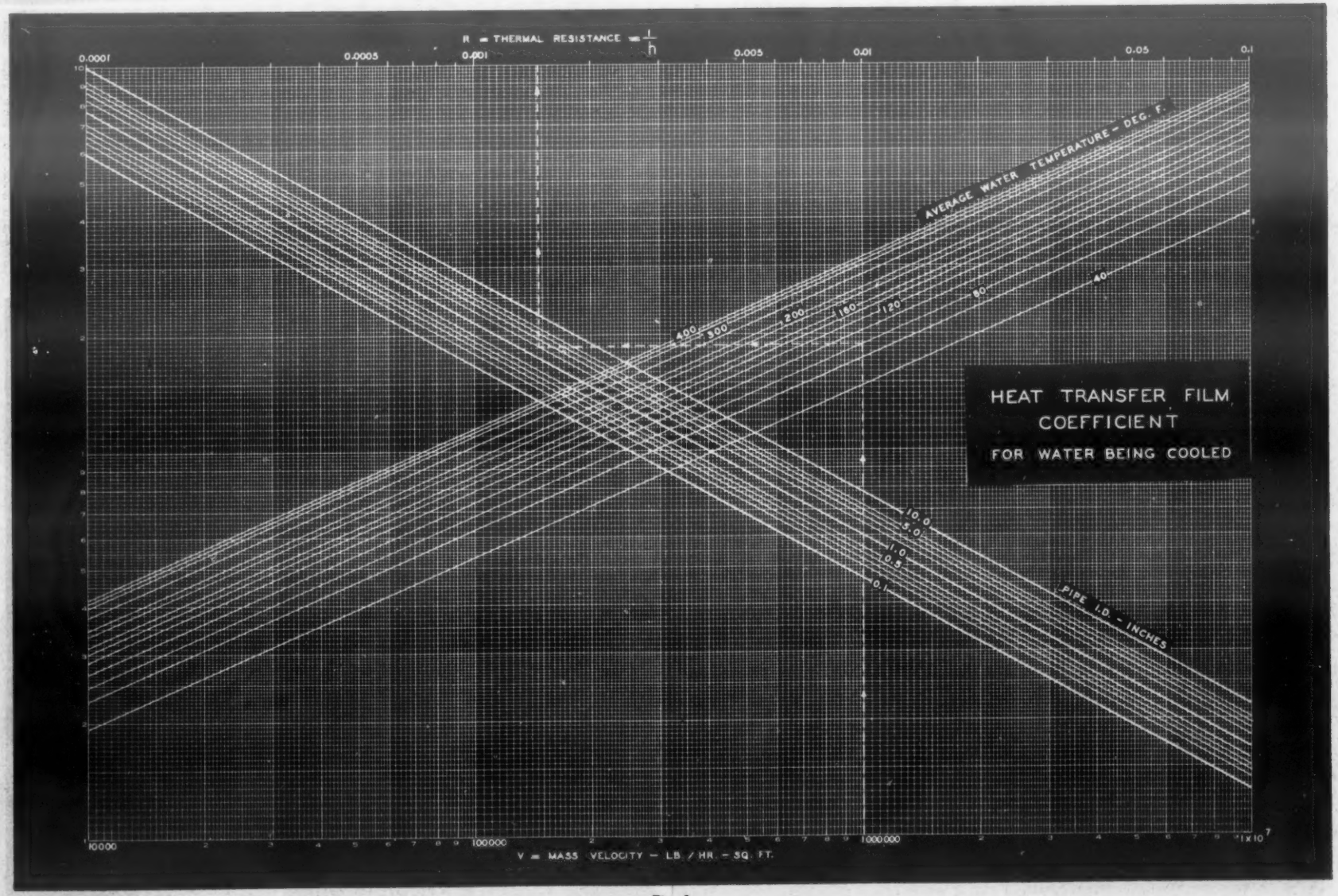


Fig. 1

calculated to be 105° F. The oil is a 40° A.P.I. crude, having a viscosity of 4 centipoises at 85° F., the average temperature.

Estimate the required length of the exchanger.

Solution.—The total resistance to the transfer of heat is made up of three resistances, the water film, metal wall, and oil film. These resistances will be calculated in the above order.

(a) Water side.—The flow of 1,000 gal. per hour through the exchanger corresponds to a mass velocity of 360,000 lb./hr.-sq. ft. (See The Oil and Gas Journad, July 1, 1944, p. 50.) Using the accompanying chart to obtain the thermal resistance on the water side, start at a mass velocity of 360,000 on the bottom scale, rise vertically to an average water temperature of 140° F. Then move horizontally to a pipe inside diameter of 2 in. From this point, rise vertically and read a value of "R_i" = 0.00225 on the top scale.

(b) Metal wall.—From a table of standard pipe sizes, the wall thickness of a 2-in. standard pipe is found to be 0.154 in. The resistance of the metal wall is R = 0.0003. (See The Oil and Gas Journal, June 17, 1944, p. 99). This figure should be converted to an equivalent resistance, based on the inside pipe diameter.

$$R_w = 0.0003 \times \frac{2 D_i}{(D_i + D_o)} = 0.0003 \times \frac{2 \times 2.067}{2.067 + 2.375} = 0.00028$$

(c) Oil side.—The area of the annular section, through which the oil flows, can be obtained from information in a table of standard pipe sizes and is found to be:

A = 7.393 — 4.430 = 2.963 sq. in.

Using this area and the quantity of 1,000 gal. per hour, the mass-velocity is found to be 330,000 lb./hr.-sq. ft. (See The Oil and Gas Journal, July 1, 1944, p. 50.)

The equivalent heat transfer diameter is:

$$D' = \frac{\text{Annular area} \times 4}{\text{Heated perimeter}} = \frac{2.963 \times 4}{7.461} = 1.59 \text{ in.}$$

The Reynolds' number for the oil is found to be 4,500 and the thermal resistance, R = 0.019. (See The Oil and Gas Journal, July 15, page 105.) The above resistance for the oil film is corrected to an equivalent resistance, based on the inside pipe diameter of the inner pipe, or:

$$R_o = 0.019 \times \frac{2.067}{2.375} = 0.0166$$

The total resistance is the sum of the above three resistances, or,

$$R_t = 0.0166 + 0.00028 + 0.00225 = 0.01913$$

The over-all coefficient is the reciprocal of R_t, or,

U=1/0.01913=52.3 B.t.u./hr.-sq.ft.-°F.

The log mean temperature difference, based on countercurrent flow is:

t_m = 54.5° F.

The amount of heat to be transferred can be obtained from the heat balance of water to be cooled. 1,000 gal. per hour is equivalent to 8,330 lb. per hour.

q = 8,330 × (150—130) = 166,600 B.t.u./hr.

The necessary area for the required heat exchanger is obtained as follows:

A = q/UΔt = 166,600/(52.3 × 54.5) = 58.5 sq. ft.

Based on the internal pipe surface, and from data contained in a table of pipe sizes, it is found that 1.847 ft. of 2-in. pipe are required for 1 sq. ft. of pipe area.

The required length of the exchanger then, is:

L = 1.847 × 58.5 = 108 sq. ft.

If the exchanger is made up of 10-ft. sections, a total of 11 sections will be required for the exchanger. In the above calculations, no allowance was made for fouling which should be given consideration by means of an appropriate safety factor.

Notation:

- q = rate of heat transfer, B.t.u./hr.
- U = over-all coefficient of heat transfer, B.t.u./hr.-sq. ft.-°F.
- Δt = true mean temperature difference, °F.
- t_m = log mean temperature differerence, °F.
- F = correction factor for tubular heat exchangers, dimensionless
- h = film coefficient, B.t.u./hr.-sq. ft.-°F.
- R_i, R_o, R_w = thermal resistances = 1/h.
- k = thermal conductivity, B.t.u./hr.-ft.-°F.
- d = pipe diameter, feet
- D = pipe diameter, inches
- V = mass velocity, lb./hr.-sq. ft.
- Z = viscosity, lb./ft.-hr.
- μ = viscosity, centipoises
- C = specific heat, B.t.u./lb.-°F.

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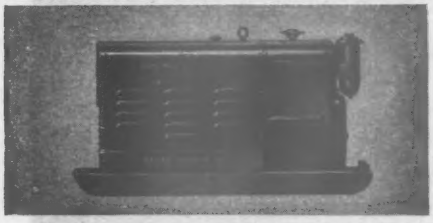

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REFINING

PAW Offers No Fixed Rule In Reducing Octane Rate

WASHINGTON.—Following its directive reducing the octane rate of housebrand gasoline from 72 to 70, Petroleum Administration for War is imposing no fixed rule in granting exceptions for unreasonable or unusual hardships, but is urging that conditions in individual cases be examined before exceptions are granted.

Refineries conducting reforming and cracking operations will obtain exceptions if they cannot produce unleaded 70-octane gasoline without hindering war production, but possible alternatives are suggested.

Where several refineries supply a common pipe line or terminal, one may produce better than 70-octane gasoline and others below, so the blend will average out and save lead; or gasoline may be exchanged between companies and blended with the same result.

Refiners will be asked to take all possible steps to separate better components from housebrand and use them as a substitute for lead in premium fuel or in war products. Volatility of gasoline and unnecessary use of natural or other octane improvers are to be studied before granting exceptions.

United States Bombers Hit Ploesti Oil Refineries

LONDON.—Five oil refineries and a pumping station at Ploesti were blasted July 15 by 750 United States heavy bombers flying from Mediterranean bases. Columns of smoke 20,000 ft. high rose over the Rumanian oil center and crews looking back said the smoke was visible for more than 100 miles. Escorting Mustangs downed enemy fighters who challenged the big armada.

Santa Maria Property Is Being Reconditioned

LOS ANGELES.—Western Asphalt & Refining Co., which recently acquired the property and equipment of the new Santa Maria Refining Co. on Point Sal road west of Santa Maria, Calif., is doing some reconditioning work under supervision of Jack H. Burrows, manager of refinery operations. Owners of the plant are Burrows, Herbert Phillips and Donald M. Prentice, former refinery superintendent for the 5-C Refining Co. Western Asphalt is processing Santa Maria Valley residuum, but may operate later on crude oil produced in the general area.

California Premium Gasoline Quota Changed

WASHINGTON. — California refiners have been given a new base period on which to figure their permitted production of premium-grade gasoline through an amendment to Petroleum Distribution Order 21 issued by the Petroleum Administration for War.

Refiners in other sections of the country are limited to 50 per cent of production during the 6 months ended April 1, 1944. Refineries in California are now limited to 45 per cent of average production during March, April and May of 1944. The reason for this is that many West Coast refineries were producing unusual quantities of war products last winter at the expense of premium motor gasoline, and the different base period and percentage rate was calculated to give approximately the same results for future operations as applies to other regions.

Oil Executives Meet for Butadiene Discussions

WASHINGTON. — Seven representatives of the oil industry interested in the manufacture of butadiene met officials of the State Department here last week for discussions preliminary to the pending tripower rubber conference.

The seven, invited to the meeting to acquaint them with the State Department's plans in connection with the rubber discussions, were M. J. Rathbone, president Standard Oil Co. of New Jersey; H. A. Trower, vice president Phillips Petroleum Co.; Col. J. F. Drake, president Gulf Oil Corp.; E. Y. Isom, vice president Sinclair Refining Co.; W. S. S. Rodgers, chairman of The Texas Co.; William R. Boyd, Jr., chairman Petroleum Industry War Council,

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and William D. Crompton, director of the foreign division of Petroleum Administration for War.

The tripower rubber conversations, held in London, will be attended by representatives of the United States, the United Kingdom and the Netherlands.

Refiners Asked to Increase Output of Distillate Oils

CHICAGO.—Refiners of District 2 are asked to increase their distillate-oil output to meet rising war demands, in a telegram from C. H. Alberding, director of refining for the district, Petroleum Administration for War. The telegram says:

"As a result of the direct and indirect military requirements it is necessary to increase the production of distillates in order to assure that all essential military and civilian requirements will be met. Therefore, effective immediately and until further advised, you are hereby requested to increase the total percentage of distillate oils by at least 2 per cent, based on crude input over the corresponding yield for the 60-day period ending June 30, at your District 2 refinery(ies).

"The above request should not be allowed to interfere with the maximum production of critical war products listed by PAW, nor with the directed amount of 80-octane all-purpose gasoline."

Pressure Valve Cause of Fatal Refinery Fire

OIL CITY.—Accidental release of a pressure valve caused the explosion and fire July 7 which resulted in death of eight persons and hundreds of thousands of dollars damage at the Defense Plant Corp.'s refinery here. The $5,000,000 plant, joint operation of five companies, had been running less than 2 months.

The report, issued by company officials, said release of the pressure valve allowed high-test liquid aviation gasoline to escape in vapor form. Although "there might not have been any great harm done if the gas could have expended itself in the air," the statement said, the cloud of vapor ignited in an unknown manner.

Control Tightened on Aviation Gasoline

WASHINGTON.—Control of high-octane gasoline and its components has been tightened by the Petroleum Administration for War and the Aviation Petroleum Products Allocation Committee.

This action was taken by the issuance of PAW Petroleum Directive 77 and the revocation of PAW Recommendations 8 and 16. Directive 77 became effective July 24.

Under the terms of the directive, PAW controls all transfer within the petroleum industry of aviation-grade base stock, blending agents, and high-octane aviation fuel.

Refiners now must apply to PAW for authority for transfer within the petroleum industry or for release of materials assigned by APPAC. PAW authorization must be granted before the operation begins. Previously, refiners were required to report their operations, but were not required to await specific authorization before work was started.

The new directive also provides that the PAW will specify the types and grades of high-octane aviation fuel that shall be manufactured or blended in regular commercial production.

Manufacture or blending of any grade or type of fuel, such as experimental fuel, requires specific authorization from PAW before the operations begin.

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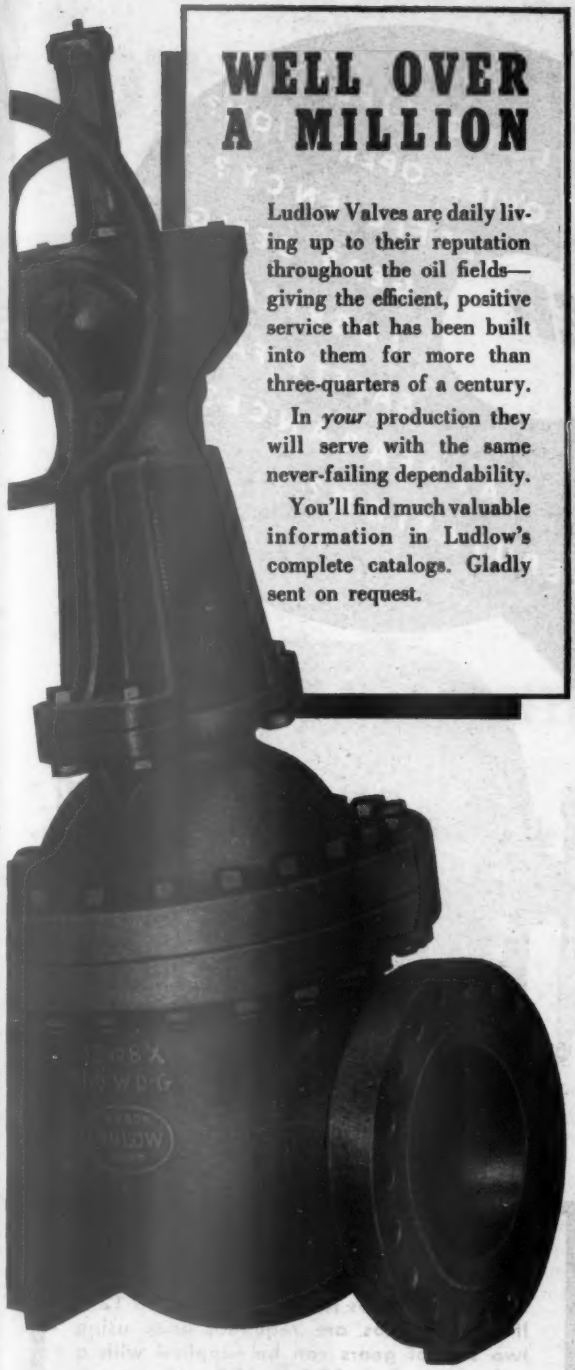

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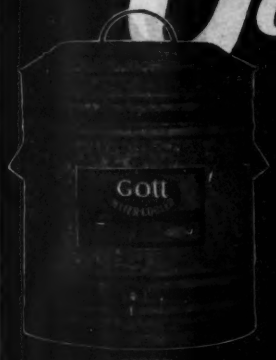

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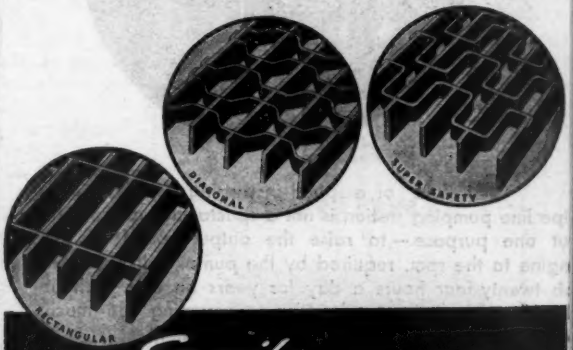

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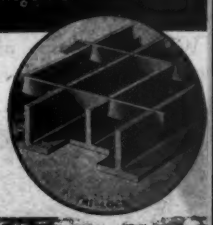

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LONG LIFE?
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EFFICIENCY?
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LUBRICATION?
SAFETY FACTOR?
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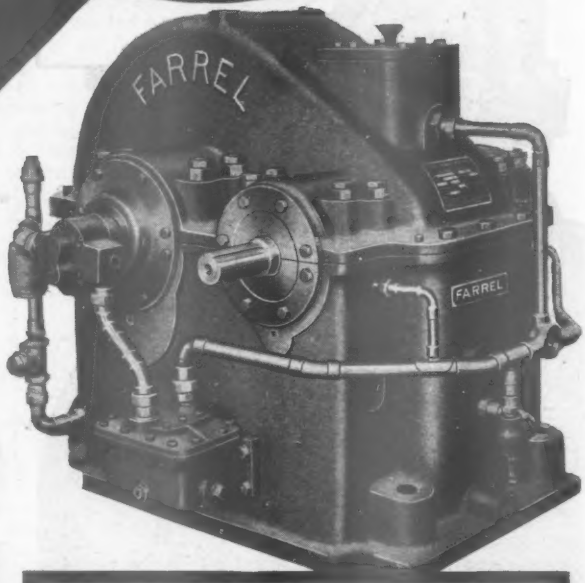

The "life" of a speed increasing gear unit in a ipe line pumping station is not a spectacular one. It has ut one purpose — to raise the output speed of the ngine to the rpm. required by the pump. If it does this ob twenty-four hours a day for years on end, without bjectionable noise, and without consuming too much ower — then it is a good piece of equipment.

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Farrel-Birmingham was the first to offer a complete ne of gear units specifically designed for speed increas- g service in pipe line pumping stations. A number of e first units installed over fifteen years ago are still n the job, operating as well as on the day they were ut into service.

Write for a copy of Bulletin SI-438 which describes ese long-lived units.

FARREL-SYKES speed increasing units are available in a standard series of 47 sizes, with speed ratios ranging from 1:1 to 12:1. If higher ratios are required, units using two sets of gears can be supplied with a ratio range from 12:1 to 40:1.

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PIPE LINES

First Texas Devonian Pool Assured Pipe-Line Outlet

MIDLAND, Tex.—A pipe-line outlet for the new pool opened in southeastern Crane County, the first Devonian production in the state, is assured. Petroleum Administration for War has approved the project of Texas-New Mexico Pipe Line Co. to lay 3 miles of 4-in. pipe from its McCamey station in southwestern Upton County to the pool.

The area was opened by The Texas Co. 1-A Hobbs, Section 46, Block 35, H&TC Survey, virtually on the Upton County line. The discovery still is being tested after showing for approximately 250 bbl. of oil daily from perforations at 5,300-50 ft. It has been perforated at 5,365-90 ft. in order to test the lower part of the pay section.

American Liberty Ordered To Pay Income and Surtax

The United States Fifth Circuit Court of Appeals held that the American Liberty Pipe Line Co. of Dallas should pay deficiencies ag-

PIPE-LINE PERSONALITIES

CHAMPION pipe-line walker of the world."

It's not just a bit of flattering exaggeration. It's what Charles E. Chamness, of Bartlesville, Okla., actually is. For 30 years Chamness walked the line unfailingly. Blistering heat, piercing cold, rain, mud, sleet—it was all the same.

And by way of signalizing a record without precedent in petroleum annals Chamness is to receive a medal from the pipe-line department of Sinclair Prairie Oil Co.

In the course of his daily trudge—watching ceaselessly for leaks, breaks in the line, or signs of possible trouble—Chamness has covered about 175,000 miles. That is to say, he would have circled the globe seven times if his path had taken him that way instead of along the 40-mile stretch between the Kansas state line and the Cherokee pump station near Ramona, Okla.

Actually this pipe-line veteran has been holding down his job 34 years; but for purposes of the record he counts the first 30 years only, for during that period he never missed a day except for his regular vacations. In the past 4 years he has been off duty at times on account of illness, and also he has not covered the full 40 miles of his route.

In the 30 years of uninterrupted service Chamness wore out two pairs of 18-in. boots and two pairs of work shoes each year.

Hard on the feet? "Oh," grinned Chamness, "you just want to keep your feet clean, wear clean, substantial socks and heavy-soled shoes—and just keep putting one foot ahead of the other."

Chamness, now nearing his sixty-fifth birthday, has received from Harry F. Sinclair, head of the big Sinclair interests, a letter which says: "We are having made a medal for you as champion pipe-line walker of the world. You will receive this award in due course and meantime I send you my sincere congratulations and my thanks for your long and noteworthy service. . . . Don't think of yourself as a has-been. You are a man who has led a good life, earned the admiration and respect of your associates, and I hope you will have much to be happy for in the future."

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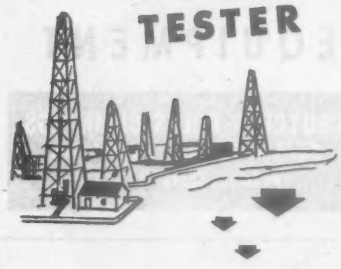

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gregating $138,011.37 in corporate income taxes and surtax on undistributed profits for the fiscal years ending November 30, 1937, and 1938.

Ohio Gets Right-of-Way For Products Pipe Line

Construction work on Ohio Oil Co.'s 115-mile 8-in. petroleum products pipe line from Robinson, Ill., to Indianapolis, Ind., will start in September, the Petroleum Administration for War reported last week, upon disclosing that 80 per cent of the right-of-way has been purchased and is 48 per cent staked.

Pipe-Line Deliveries to East Coast Set Record

WASHINGTON.—Pipe-line movements of petroleum into District 1, the East Coast, reached an all-time high during the week ended July 1, the Petroleum Administration for War reported last week in its regular periodical progress summary. Deliveries during the week averaged 706,184 bbl. daily, including 523,390 bbl. of crude oil and 280,794 bbl. of refined products.

Crude oil pumped through the 24-in. line from Longview to Norris City averaged 325,138 bbl. daily during the 6-day period ending July 7. Deliveries to the Ohio Oil Co. line averaged 13,761 bbl. daily. Pumping through the 24-in. line from Norris City to the East Coast averaged 317,387 bbl. daily during the same period, of which 152,192 bbl. daily were delivered to refineries in the Philadelphia area and 148,400 bbl. daily went to the New York area.

Following is the status of eight current projects on the construction schedule reported by PAW:

Project 23.—Yale's Elk Basin line. Seventeen miles of pipe strung and 16 miles welded on 8-in. line from Warren to Yellowstone River near Billings. Building and machinery foundations completed at all three pump stations and some equipment has been installed. Project should be completed in August.

Project 24. — Stanolind's Elk Basin to Casper line. Three gangs now working: 22 miles of pipe strung and 11 miles welded. Project scheduled for completion in September.

Project 25.—Ohio Oil Co.'s 115-mile 8-in. products line from Robinson, Ill., to Indianapolis, Ind.; 82 per cent of right-of-way purchased and 58 per cent staked. Actual construction work will start in September when shipments of pipe are made from mill. Completion date estimated in October or November.

Project 26. — Pan American Pipe Line Co.'s 36-mile 8-in. crude line from Willamar pool to Port Isabel, Tex.; 85 per cent of right-of-way procured, most of which has been cleared. Some pipe has been strung and welding operations have started. Completion date estimated in August.

Project 28.—The Texas Co.'s 34-mile 6-in. products line from Lockport, Ill., to East Chicago, Ind.; 85 per cent of pipe strung and 78 per cent welded. Pump station building at Lockport 20 per cent erected. Project scheduled for completion in July or early in August.

Project 29. — Colonial Beacon's 36-mile 4 and 6-in. products line from Everett to Methuen, Mass. Two additional survey parties and extra right-of-way man have started field work; 19 miles of right-of-way secured. Construction work will start about September 1 when pipe is scheduled for delivery. Completion date estimated in October.

Project 30. — Construction by Stanolind Pipe Line Co. of 41 miles of 16-in. loops along existing crude-oil system between Drumright, Okla., and Sycamore, Kans. Construction started latter part of July when pipe arrived. Completion date estimated in September.

Project 31. — Construction by Utah Oil Refining Co. of 112 miles of 6-in. crude pipe line from Iles Dome pool, Colorado, to Wamsutter station, Wyoming. Project approved by WPB. New line with capacity of about 5,000 bbl. daily will provide outlet for Iles Dome and Wilson Creek pools for through pipe-line movement to refineries at Salt Lake City, Utah. Pipe will be delivered in September and line should be completed by December or January at estimated cost of $1,416,000.

O.W.I.U. Designated as Bargaining Agency

WASHINGTON. — Following an election by operating and maintenance employes of Great Lakes Pipe Line Co., Kansas City, Mo., under the supervision of the regional director of National Labor Relations Board, the Oil Workers International Union (C.I.O.) has been designated as the bargaining agency to represent the employes.

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Exploration and Drilling

Week's Highlights

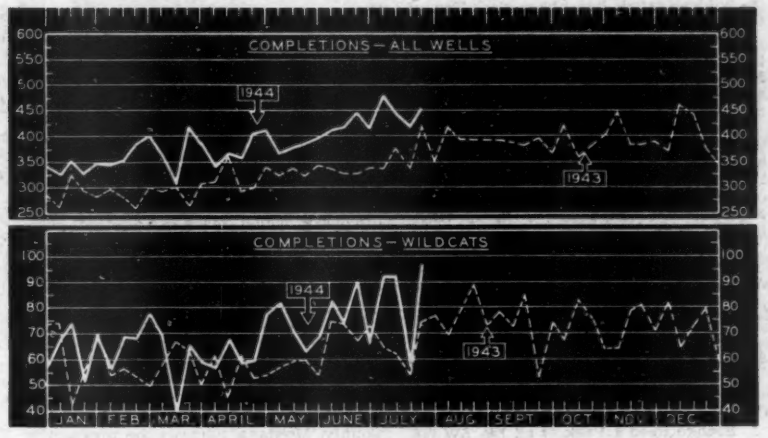
ONE of the most interesting completions this week is not a wildcat well, but an offset to a successful wildcat, an offset that was delayed for 14 years. In southern Park County, Wyoming, Husky Refining Co. has just completed a well in the SW SW SE 11-48n-102w, good for 229 bbl. on the pump from the Tensleep horizon at a total depth of 3,722 ft.

The history back of this completion indicates one of the problems of a geologist, in that occasionally he can be successful in finding an oil field, only to find that he is too far ahead of the march of progress in other branches of the industry, or that economic conditions nullify his success.

Fourteen years ago a well was drilled on the Pitchfork anticline in southern Park County, Wyoming, an anticline 4 miles long by ½ mile wide, with at least 1,200 ft. of closure, a west flank dip of 65° to 80° and an east flank dip of 35° to 45°, practically "a text book structure," the kind you would use as an illustration of an anticline in an elementary geology text. The "text book structure" test made 434 bbl. of 18.6° gravity oil. Unfortunately there were no pipe lines within economic reach of the discovery well, and no refiners eager to buy low-gravity oil. In fact few refiners anywhere would have been interested in such low-gravity oil at that time. So the successful wildcat was mudded in.

Today conditions are different, partly due to the war, partly due to progress in refining technology. But it illustrates another difficulty under which the geologist labors in searching for oil fields. Many a geologist wishes that he not only had a method of locating the presence or absence of oil in any given place, but also of determining the quality of the oil.

It is hard enough to find oil fields by the indirect approach method of seeking structural folds of an appropriate type in an area where general conditions indicate that the region has oil-producing possibilities. It is heart breaking to succeed in spite of these difficulties, only to find that the oil discovered is not of a commercially desirable grade. Fortunately such cases are rare.



Solid line charts current weekly completions

COMPLETIONS IN ALL FIELDS . . .

Week Ended July 22, 1944

	Oil	Gas	Dry	Total	Footage	Total Comp. to date 1944	1943
N. Y., Penna., W. Va.	58	26	2	86	143,998	1,782	1,775
Ohio	3	5	9	17	51,223	521	442
Indiana	2	0	5	7	14,133	118	123
Kentucky	5	2	3	10	26,229	373	191
Illinois	21	0	17	38	107,819	966	915
Michigan	3	1	13	17	40,766	343	276
Kansas	27	0	23	50	173,318	981	845
Nebraska-Missouri-Iowa	0	0	0	0	0	16	25
Oklahoma	12	2	12	26	98,919	907	603
Texas:							
North Central	20	0	17	37	112,171	784	685
West	20	0	3	23	111,069	810	444
Panhandle	5	2	1	8	24,031	111	94
Eastern	4	0	1	5	28,881	187	148
Gulf Coast	14	2	12	28	190,556	623	229
Southwest	2	1	3	6	29,499	400	474
Total Texas	65	5	37	107	496,207	2,915	2,074
Louisiana:							
Northern	2	1	3	6	33,229	159	165
Southern	7	2	8	17	113,263	263	189
Total Louisiana	9	3	11	23	146,492	422	354
Arkansas	6	0	1	7	43,202	122	134
Mississippi	6	0	3	9	53,318	68	50
Alabama, Georgia, Florida	0	0	3	3	11,882	28	†
Montana	1	1	4	6	22,900	171	107
Wyoming	3	0	1	4	16,086	87	64
Colorado	1	0	0	1	5,416	17	6
New Mexico	4	0	0	4	14,056	216	114
California	25	0	13	38	165,334	1,083	666
Total United States	251	45	157	453	1,632,299	11,128	8,764
Total previous week	239	53	123	415			
Total July 24, 1943	232	32	151	415			

*Does not include 52 pressure wells. †Included in total shown for Mississippi.

MICHIGAN

Thirteen Completions for Week Are Dry Holes

SAGINAW.—Thirteen of the past week's oil and gas field completions in Michigan were dry holes. One producer is a small gas well, the others small oil wells, including a Dorr Township, Allegan County, wildcat rated at 5 bbl. a day. Ten of the dry holes were wildcat tests.

Michigan Oil and Gas Association reported average daily oil production from 3,376 Michigan wells in June was 50,083 bbl. or 1,500 bbl. less than in May. Nearly all fields declined slightly in productivity.

Permits this year climbed to 345 as the state Conservation Department issued 15 more last week, two each for locations in Isabella, Montcalm, Ogemaw and Genesee counties, one each for Barra, Ottawa, Montmorency, Muskegon, Allegan, Sanilac and Lake.

MICHIGAN WILDCAT COMPLETIONS

Allegan County, Dorr Township: C. A. Perry 1 William Bieber, SE NW NW 4-4n-12w, dry at 1,683 ft., pumped 5 bbl. oil and salt water.

Arenac County, Moffatt Township: Don Rayburn 1 State-Moffatt, C S½ SW NE 27-20n-3e, dry at 3,160 ft.

Calhoun County, Albion Township: J. Brooke Reed 1 Peak et al, E½ SW NE 10-3s-4w, dry at 1,600 ft.

Mecosta County, Aetna Township: H. L. Wadsworth 1 Emma E. Sarns, SE NW SE 7-13n-10w, dry at 3,307 ft.

Deerfield Township: Sohio Petroleum Co. 1 Flora Chaney, C S½ SE SW 16-13n-9w, dry at 3,646 ft.

Montcalm County, Montcalm Township: Allegan Pipe & Supply Co. 1 E. Martins, NW NW NW 11-10n-8w, dry at 3,260 ft.

Osceola County, Hersey Township: Sun 1 John W. Segraves, SW NE SW 11-17n-9w, dry at 1,378 ft.

Ottawa County, Tallmadge Township: P. K. De Genther 1 Mabel Bonner, SW SW SE 6-7n-13w, dry at 1,983 ft.

Van Buren County, Keeler County: Clapsaddle Drilling Co. 1 Sikes, C N½ SE SW 18-4s-16w, dry at 860 ft.

Paw Paw Township: S. L. McCall 1 R. T. Vincent, SE SE SE 32-3s-14w, dry at 1,109 ft.

ROCKY MOUNTAIN

Pitchfork Structure Revived After 14 Years

DENVER.—Fourteen years after the discovery well on the Pitchfork structure in Park County, Wyoming, was completed, the Husky Refining Co. has brought in the second producer at its 3 Goverment, SW SW SE 11-48n-102w. It had the top of the Tensleep at 3,515 ft., was drilled to 3,722 ft., and pumped 229 bbl. per day. It is a north offset to the discovery which made 434 bbl. of 18.6-gravity oil from the Embar at 3,350-56 ft. and the Tensleep at 3,600-15 and 3,743-83 ft., following 4 shots with 400 qt. Later the discovery was mudded in. Pitchfork is a long narrow anticline 4 miles long and ½ mile wide with steep dips on both sides and at least 1,200 ft. of closure. The west flank dips 65 to 80° and the east flank 35 to 45°.

Three Dry Holes at Gage.—Three dry holes in the Gage field, Musselshell County, Montana, narrows the prospective producing acreage. Northern Ordnance, Inc. 1 McTavish, 2½ miles west of the discovery, was dry in the Amsden at 6,300-6,437 ft. No. 3-A Morris, in the same section as the discovery and a north offset to 2-A Morris, a producer, was dry. No. 4 Darr, a north offset to 1 Darr, which flowed 358 bbl. in 24 hours, also was dry.

Northwest New Mexico.—Southern Union Production Co. has spudded 9 Barker Dome, SE SE NW 21-32n-14w, San Juan County, northwest New Mexico, to go to granite expected at 10,000 ft. This will be an important wildcat as very few tests in that area have gone below the Dakota sands. Barker Creek structure produces gas from the Dakota at around 3,200 ft.

WYOMING WILDCAT COMPLETION

Fremont County, Little Dome: Superior Oil 1 Little Dome, SW SE SE 10-8n-1w, dry, TD 4,111 ft. Dry in steep dips after testing Embar and Tensleep.

MONTANA WILDCAT COMPLETIONS

Musselshell County: Northern Ordnance 1 McTavish, NE NE 19-9n-26e, (2½ mi. west of Gage pool), dry, TD 6,437 ft. Amsden 6,300 ft.

Pondera County (Midway): R. C. Tarrant 1 Kortlever, NE NE NE 25-28n-2w, dry, show of oil and 500 ft. water in Sunburst 1,732-56 ft., TD 1,756 ft.

CALIFORNIA

Two Imperial Valley Deep Tests Apparent Failures

LOS ANGELES. — The first two deep conclusive tests in California's Imperial Valley are apparent failures and though they do not condemn the entire valley they may retard further prospecting. Standard Oil Co. of California is abandoning 1 Southern Land at San Felipe, 27-11s-9e, at 4,547 ft. in hard sandstone. Pure Oil Co. drilled into either a very hard conglomerate or basement material at 5,830-65 ft. in 1 Truckhaven Comm., 26-10s-9e, and is expected to stop work within the next few days. Northeast of these tests O'Quinn & Hadley have spudded a wildcat in the Salton Sea area in 11-9s-12e, where carbon dioxide gas has been produced in limited quantities for several years.

Another significant failure is Standard of California S-1 on the 35 anticline in the Midway-Sunset field of Kern County. The test was on what had been considered a promising anticline with deep-zone possibilities. Production at comparatively shallow depths has been developed on the 35 anticline, but Standard did not regard the outlook as promising and stopped at 8,647 ft. This deep test was on property of Ethel D Co. in 36-12n-24w. It was expected Standard would go down to at least 10,000 ft., but the geologic column failed to justify drilling below the point at which work was stopped. Standard also abandoned its deep Fillmore wildcat in Ventura County, 24-4n-20w, and the crew is pulling out at 14,512 ft. It was drilled with butane and is probably the deepest hole drilled in the state with this type of power.

Tide Water Associated Oil Co. is working on what may prove an important wildcat in the Gosford district of Kern County, although the formation appears tight. On the basis of the showing found in the first well, the operator has staked location for a second, on acreage leased from Kern County Land Co. in 22-30s-26e. The initial wildcat, 44-22 Kern County Land, has been bottomed at 8,152 ft. and cleaned out to 7,860 ft. after perforating the casing at 7,935-50 ft. At this depth the crew bailed practically all oil, but the well failed to show enough gas to result in a natural flow. The fluid level is at 6,000 ft. and if acidizing fails to result in a natural flow, the company appears to have the making of a small well on the beam.

CALIFORNIA WILDCAT OPERATIONS

Fruitvale outpost well, Kern County: T.W.A.O. Co. 68-23 Bittner, 23-29s-27e, dry at 4,531 ft.

Kern Bluff wildcat district, Kern County: Independent Exploration Co. 21 Trust, 14-29s-28e, dry at 1,720 ft.

DAILY AVERAGE PRODUCTION FOR WEEK

	July 22 crude oil	Distillate, allied products	July PAW quota all oils	July 15 crude oil
Arkansas	80,500	4,500	82,500	80,550
California	855,250	50,700	904,200	854,750
Colorado	7,800	.....	7,400	7,800
Eastern	66,100	6,200	77,400	63,000
Illinois	206,550	11,500	226,500	197,950
Indiana	12,800	.....	14,600	13,900
Kansas	285,300	5,000	279,000	278,800
Kentucky	24,400	2,200	24,200	21,800
Louisiana	359,050	45,000	395,000	357,550
North Louisiana	72,050	.....	.....	72,150
South Louisiana	287,000	.....	.....	285,400
Michigan	50,500	200	51,200	49,300
Mississippi	44,950	.....	41,000	44,000
Montana	23,600	300	24,700	20,700
Nebraska	950	.....	1,000	900
New Mexico	108,250	5,000	118,000	107,750
Oklahoma	341,200	27,000	359,000	341,250
Texas	2,067,300	140,000	2,204,000	2,067,300
East Texas	363,550	.....	.....	363,550
East Central Texas	148,300	.....	.....	148,300
North Central Texas	151,600	.....	.....	151,600
Texas Panhandle	89,150	.....	.....	89,150
West Texas	463,550	.....	.....	463,550
South Central (San Antonio)	19,700	.....	.....	19,700
South Texas (Laredo)	78,200	.....	.....	78,200
Lower Gulf Coast	221,850	.....	.....	221,850
Upper Gulf Coast	531,400	.....	.....	531,400
Wyoming	87,900	4,000	98,000	86,300
Total United States	4,622,400	301,600	4,907,700	4,593,600
Total production January 1-July 22, 1944				910,763,800 bbl.
Same period last year				799,343,335 bbl.

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McKittrick outpost well, Kern County: Richfield 1 Olig, 12-30s-21e, dry at 2,302 ft.

Mount Poso outpost well, Kern County: Signal Oil & Gas Co. 1 Martin, 14-27s-28e, dry at 1,087 ft.

North Whittier Heights, Los Angeles County: Capital Co. 2-1 Baldwin, 11-2s-11w, pump 40 bbl. 20.9-gravity, 3 per cent cut, perf. 1,100-1,285 ft., discovery in new fault accumulation, TD 1,285 ft.

Old River wildcat district, Kern County: Richfield 1 K.C.L., 3-31s-26e, dry at 9,191 ft.

Santa Rosa Rancho wildcat district, Santa Barbara County: Texas 2 Petan, 20-6n-32w, dry at 2,111 ft.

Stockton wildcat district, San Joaquin County: Standard 1 Fairoaks Comm., 19-1n-7e, dry at 6,500 ft.

K. & G. Drilling Co. 2 Temblor, 25-29s-20e, dry at 666 ft.

Temblor wildcat district, Kern County: K. & G. Drilling Co. 1 Temblor, 25-29s-20e, dry at 701 ft.

PERMIAN BASIN

Important Extension Made To Andrews County Field

MIDLAND. — The big Fullerton field, Andrews County, has been extended 1½ miles eastward by one of the largest wells in the area. Frank and George Frankel 1-D University, Section 3, Block 13, logged the Fullerton pay series from 6,770 ft. to 6,980 ft., total depth, where it flowed 365 bbl. of oil in 65 minutes before being shut in for storage. The well had made 75 bbl. an hour from pays above 6,930 ft., after acidizing, but apparently had a big increase in the bottom 50 ft. Operators tried to treat the pay at 6,930-80 ft., but the formation would not take the acid.

Mid-Continent Petroleum Corp. 1-7 University, prospective wildcat Wolfcamp section producer, was drilling ahead below 8,850 ft. in hard brown lime, with no additional shows reported below 8,470-8,670 ft., the Wolfcamp zone, which indicated commercial production. Union Oil Co. of California 1 Scarborough was completed last week flowing 252 bbl. of oil in 24 hours from 7,020 ft., extending the Union pool ¾ mile southeastward. Stanolind Oil & Gas Co. 1-D University, 11,000-ft. wildcat in Section 6, Block 11, University Lands, was drilling below 4,625 ft.

Mitchell County.—Humble Oil & Refining Co. has staked location for a 9,000-ft. Ordovician wildcat at 1 Keel, 5 miles northwest of Colorado City, 1,980 ft. from east and 660 ft. from south lines of Section 22, Block 27, T&PRR Survey.

Gaines County.—Bay Petroleum Corp. 1 Bettie Cox et al cored lime showing traces of oil, gas and probably water at 4,828-40 ft., 4,872-90 ft. and 5,016-33 ft. and was coring again at 5,150 ft. Humble 1 M. S. Doss cored 8 ft. of dolomite with slight porosity and oil stain at 6,601-12 ft. and was shut down for repairs at total depth of 6,612 ft. Stanolind 1 T. S. Riley, wildcat 7 miles west of Cedar Lake pool, is testing after acidizing at 5,141 ft. It has been showing for possibly a small producer.

Pecos County. — Humble 1 H. O. Word estate was drilling past 8,163 ft. in black shale. Standard Oil of Texas 2 Edith L. Trees et al was drilling at 8,035 ft. in shale, lime and chert. Humble 1 Williams, small wildcat producer northwest of Fort Stockton, is reported averaging about 17 bbl. of oil daily.

Culbertson County. — Humble 1-B Reynolds Cattle Co., projected 8,000-ft. wildcat 10 miles northeast of Plateau, was drilling at 3,972 ft. in gray lime and streaks of chert.

Crockett County. — Continental Oil Co. et al 10-B J. S. Todd, Todd deep field, swabbed 100 bbl. of oil in 24 hours after treating the Ellenburger at total depth of 6,232 ft. with 4,000 gal. of acid, and has plugged back to 5,988 ft. to complete in the field's regular Crinoidal lime pay.

WEST TEXAS WILDCAT COMPLETION

Concho County: B. A. Duffey et al 1 Robert Wilson; 660 ft. N and W lines, Sec. 76, Blk. 8, H&TC Sur., SW part county, elev. 2,309 ft., dry, TD 3,897 ft.

PANHANDLE

AMARILLO.—Humble Oil & Refining Co. has made location for its J. W. Hyslop in extreme western Deaf Smith County, on a 14,000-acre block straddling the Texas-New Mexico state line. It is 1,980 ft. from the south and east lines of 18-3n-1e, and contracted to drill to 8,000 ft. or to granite. The drilling block extends westward from Deaf Smith County, Texas, into Curry County, New Mexico.

Dallam County.—Pure Oil Co. 1 J. T. Sneed, Jr., topped granite at 6,769 ft. and has been plugged at total depth of 6,779 ft.

Hutchinson County.—Humble 1 S. B. Lasater, wildcat, logged small shows of oil at 3,150 ft., 3,175-80 ft., 3,195-3,200 ft., shows of gas at 3,220-25 ft., at which depth it tested 2 bbl. of water and one-third bbl. of oil in 9 hours. It continued drilling below 3,264 ft. Contract depth is 3,310 ft.

PANHANDLE WILDCAT COMPLETION

Wheeler County: Portman & Jenkins 1 Sammons, Sec. 7, Blk. A, H&GN Sur.,

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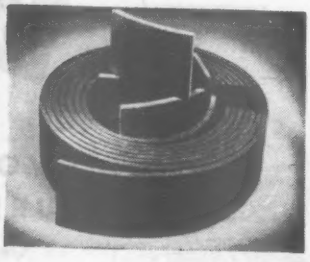

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semiwildcat 2½ mi. W of Twitty, dry, TD 2,520 ft.

SOUTHEAST NEW MEXICO

HOBBS.—George P. Livermore, Inc. 1-H State, west outpost to the Caprock pool in northwestern Lea County, flowed 300 bbl. of oil in 12 hours, with swab in the hole, from a foot of red sand at 3,016-17 ft., total depth. This well is 660 ft. from the north line and 330 ft. from the east line of 36-12-31, and is in Chaves County.

In the new Turner pool, North Central Lea County, Fred Turner, Jr., 1-C State, ½ mile due north of the discovery well, topped San Andres lime at 4,700 ft., only about 20 ft. low to the discovery. It should reach the 5,150-ft. pay zone this week. Four other tests are getting started in this pool. L. H. Wentz 1-B State is ¼ mile west of Turner's 1-B State discovery. Magnolia Petroleum Co. 5-R State is ½ mile west of the discovery. Stanolind Oil & Gas Co. 1 State is ¼ mile east of the discovery. Humble Oil & Refining Co. 1-P State is ¼ mile south of the producer. All four of these wells were expected to spud this week. An Ordovician wildcat in southeastern Lea County, Humble 1 Federal-Leonard Oil Co., was drilling below 11,188 ft. in shale.

EASTERN TEXAS

Phillips Stakes Tests Near Smith County Discovery

DALLAS.—Location for four deep wildcat tests were announced in East Texas during the past week. Two were staked by Phillips Petroleum Co. in Smith County, in the area south of Tyler, where Phillips 1 McMinn opened a new Rodessa pay zone field. The company's 1 L. A. Grelling, Jr., was staked in the Thomas Price Survey, approximately a mile northwest of the discovery. The other location, 1 Amelia Englander, is obtu 5 miles southwest of the discovery in Survey No. 1, D. T. Quevado Survey. The discovery well continues testing, its last reported gage giving it 167 bbl. of 48.8° oil in 24 hours through ⅛-in. choke.

Bowie County.—Barnsdall Oil Co. 2 Heilbron, new Smackover lime discovery, is making a larger wet gasser than indicated on first tests. Producing from the Smackover lime through casing perforations at 7,686-96 ft., total depth 7,701 ft., it made a series of tests after erection of separator. On ⅛-in. choke it produced 25 to 30 bbl. of distillate daily. Placed on a ¼-in. choke, it flowed 75 bbl. of straw-colored distillate, 71.0° gravity, with 3,360,000 cu. ft. gas in 24 hours. Through open 2-in. tubing it gaged 12,700,000 cu. ft. of gas, and when flowed for a short while through open casing it was estimated good for 75,000,000 to 100,000,000 cu. ft. of gas.

Van Zandt County.—Humble Oil & Refining Co. 1 R. W. Bruce, Jr., et al is a new wildcat location 3,400 ft. from the northeast and 3,800 ft. from the southeast lines of the J. Saligna Survey, 4 miles south of Edgewood, scheduled to test the Travis Peak sand.

Cherokee County.—Humble is rigging up for a deep well about a half-mile south of the Larissa area small discovery producer. The new test is 1 S. T. Stanley, 2,500 ft. from the south line and 4,200 ft. from the north line of the J. P. Vaughn Survey.

Wood County: Sinclair Prairie Oil Co. is preparing to drill a 12,000-ft. wildcat about 7 miles northwest of Hawkins, at 1 Minnie Collins, spotted 1,500 ft. from east and 5,500 ft. from south lines of the M. Renlarez Survey.

N. CENTRAL TEXAS

Output Declines in Shallow Cooke County Discovery

WICHITA FALLS.—Paul B. Scott 1 A. P. Walterscheid, wildcat in the E. Langford Survey, southwest of the Danglmeyer field, Cooke County, was initially reported good for 1,000 bbl. daily from sand at 2,602-10 ft., total depth, but after being shut in for 12 hours and then opened, it flowed 50 bbl. of oil, then died. After running tubing it again flowed 50 bbl., in about 2 hours, and died. It will be put on the pump. Its production is light-green 40° gravity crude. Another Cooke County wildcat, Northern Ordnance, Inc. 1 Nennie Adams, 5 miles south of Burns City, Burden Survey A-114, topped Ellenburger at 2,010 ft., logged dolomite with slight stain and odor of oil at 2,326-30 ft., was drilling below 2,416 ft. in dry lime.

Denton County.—Northern Ordnance 1 McDonald was dry at total depth of 3,304 ft.

Clay County.—Continental Oil Co. and Edge Oil Co. 1 Crockett, wildcat attempting to develop production from Simpson dolomite through casing perforations at 6,850-6,602 ft., after treating with 2,000 to 5,000 gal. of acid, swabbed 88 bbl. of oil and 461 bbl. of salt water and has squeezed perforations. It is east of Buffalo Springs. Continental 1 G. W. Scaling A, northeast offset to the Scaling pool discovery well in southwestern Clay County, topped the Caddo at 5,317 ft., recovered only 8 ft. of mud, with no shows on a drill-stem test at 5,570 ft. and shut down for orders at total depth of 5,585 ft.

Hardeman County.—Humble Oil & Refining Co. 1 T. F. Reilly logged streaks of lime showing oil at 5,754-5,862 ft., made a drill-stem test on the zone, open 58 minutes and recovered 240 ft. of mud with a scum of oil. Drilling ahead, it had granite wash with slight show of oil at 6,000-25 ft. Cored from 6,025-45 ft., it recovered 20 ft. of hard granite wash, with gas odor. It is drilling ahead below 6,250 ft. in shale. Humble staked location for a new 7,500-ft. wildcat at 1 Emma T. Marshall, in Section 240, 10 miles northwest of Quanah.

NORTH TEXAS WILDCAT COMPLETIONS

Archer County: G. T. Kimbell 1 Grace A. Baker, Hooper and Wade Sur., 2 mi. S. Archer City, dry, TD 1,223 ft.

Jack Wilder 1 J. M. McCarthy et al, R. Chisholm Sur., A-71, 6 mi. E and 3 mi. N Megargel, dry, TD 1,463 ft.

Clay County: Northern Ordnance, Inc. 1 F. Schneiderjan, E. Yeoman Sur., A-1173, 3 mi. SW Gainesville, Ellen. 2,830 ft., dry, TD 2,908 ft.

W. H. Spradling et al 1 F. Trubenbach, P. Davidson Sur. A-337, 5 mi. NW Muenster, dry, TD 1,160 ft.

Montague County: Magnolia Petroleum Co. 1 R. P. Black, A. J. Miller Sur., Sec. 12, 2 mi. NE Nocona, Ellenburger 5,470 ft., dry, TD 5,559 ft.

Wichita County: C. Y. Gorman 2 W. L. Doyle A, G. Wheelwright Sur. A-320, 9 mi. E Burkburnett, broken sand showing oil 1,196-1,210 ft., pumped 2 bbl. oil and 1 bbl. water per day, TD 1,210 ft.

Maguire Industries, Inc. 1 J. P. Cunningham "Swain," Tarrant CSL, A-282, Sec. B, 3 mi. NW Iowa Park, dry, TD 4,424 ft.

Wilbarger County: Humble 1 E. McDaniel, Sec. 56-15-H&TC, 1 mi. SE Doan, elev. 1,198 ft., Chester lime 6,342 ft., dry, TD 6,580 ft., lime.

Joe A. Worsham 1 H. Lewis, Sec. 10-9-H&TC, 6 mi. SW Vernon, dry, TD 3,160 ft.

Young County: Burk Royalty Co. 1 E. C. Stovall, Sec. 495, TE&L Sur., 5 mi. W and 1 mi. N Newcastle, sand 4,352 ft., 148 bbl. oil in 10 hours, TD 4,363 ft.

WEST CENTRAL TEXAS

ABILENE.—New wildcat locations announced in West Central Texas assured continuation of the steady wildcatting campaign in that district. C. I. Production Co., of Houston, will drill 1 C. E. Lund, 14 miles northwest of Hamilton, Hamilton County, to 4,500 ft. It is in the southeast corner of a 773-acre tract in the B. A. Carter Survey. Whitaker Oil Co. of Fort Worth will drill a 3,700-ft. Ellenburger wildcat 7 miles southeast of Ranger, on a 2,000-acre block south of the Sibley pool, the well to be carried as 1 F. S. Crawley, in the northeast corner of a 108-acre tract, Section 5, Harvey Kendrick Survey, Eastland County. In southeastern Haskell County, Humble Oil & Refining Co. has located 1 S. W. Scott, 660 ft. out of the southwest corner of a 690-acre tract, Section 20, C. W. Brooks Survey, looking for Palo Pinto lime production. R. H. Roark, of Albany, has spotted 1 H. D. Swann et al, a 3,300-ft. wildcat in Section 281, I. Miley Survey, 8 miles north of Trent.

WEST CENTRAL TEXAS WILDCAT COMPLETIONS

Jones County: Geochemical Surveys, Inc., et al 1 A. A. Gustafson, 1,050 ft. N line, 2,150 ft. E line, Sec. 8, Blk. 4, H&TC Sur., 3 mi. SW Stanford, dry sand 3,445-3,510 ft., Palo Pinto 4,105-75 ft., dry, TD 3,686 ft., shale.

Merry Bros. and Perini et al 1 Ida L. Weaver, 330 ft. S and E lines Sec. 6, Blk. 17, T&P Sur., 2½ mi. SW Truby, Cook sand 2,461-2,465 ft., pumped 72 bbl. oil in 23 hours, 38 gravity, TD 2,474 ft., lime.

Jones County: Standard Oil Co. of Ohio 1 R. O. Caffey et al, 4,950 ft. from N line, 330 ft. from W line A. Waggoner Sur. No. 206, 8 mi. SW Anson, base anhydrite 1,447 ft., lime 1,971-73 ft., hole full water, dry, TD 2,730 ft., lime.

TEXAS GULF COAST

British American Opens New Sand at Needville

HOUSTON.—British American Oil Producing Co. has opened a new, deeper sand at the Needville field in Fort Bend County, in the lower Frio zone, at the 1 Ed Hurta et al, in Robt. Hodge Survey 33, about ½ mile southwest of the Goldston 1 Lehman. Total depth is 6,852 ft., with 5½-in. casing set at 6,798 ft. The well is testing in perforations from 6,547-52 ft., through drill stem, and flowed 72.39 bbl. oil in 21 hours and 45 minutes with tubing pressure 2,175 lb. It was still showing a little mud at latest report. This test also picked up several other sands which indicated production, showed gas below the present testing level, and indicated oil production at the 5,187-5,201-ft. level where it recovered pipe-line oil on drill-stem test.

American Republics Corp. and Houston Oil Co. of Texas 2 H.&T.C.-Fee in Section 189, 933 ft. west of the discovery well at Beech Creek field, in Hardin County, is drilling at 7,866 ft. The discovery well was completed several weeks ago in the Cockfield sand. The No. 2 well is going down to test the Wilcox, after picking up oil sand at 6,240-45 ft. in the Cockfield.

UPPER GULF COAST WILDCAT COMPLETIONS

San Jacinto County: Humble 1 T. S. Fos-

ter estate, Tr. 1, Cold Spring area, Linda Saunders Sur., dry at 8,182 ft.

Stanolind 1 Thomas S. Falvey, J. Fernandez de Rumayer Sur., 6 mi. SE of Shepherd, dry at 9,759 ft.

SOUTH LOUISIANA

Union Oil Finds Production And New Sand at Gordon

NEW ORLEANS.—Union Oil Co. of California 3 Edgewood L. & L. Co. in 25-6s-10w, at Gordon in Beauregard Parish, opened oil production and a new sand at the field in completing in perforations at 5,319-21 ft. The well flowed 106 bbl. on ½-in. choke with tubing pressure 475 lb., casing pressure 875 lb., 0.3 per cent water, gravity 23.8°. Total depth is 6,904 ft. with 5½-in. casing set at 6,823 ft. The discovery well of this area, Union Oil 1 Edgewood, completed last March, flowed gas-condensate from perforations at 6,767-70 ft. The 2 Edgewood was dry at total depth of 6,950 ft.

Humble Oil & Refining Co. I-B Petit Anse Co., 23-13s-5e, at Avery Island, in Iberia Parish, was completed in perforations at 10,162-75 ft., flowing at the rate of 369 bbl. on 10/64-in. choke, gas-oil ratio 563, tubing pressure 1,500 lb., gravity 42.2°. This opens a new deep sand for the area and extends production. Total depth is 10,546 ft.

Gulf Refining Co. has completed its 8-A Schlicher-Thomas in 3-4s-1w, on the south flank of the Pine Prairie dome, Evangeline Parish, in perforations at 9,272-80 ft. and 9,286-93 ft., flowing 110 bbl. on ¼-in. choke with tubing pressure 225 lb. This hole had been drilled to 10,669 ft., with 6-in. casing set on bottom, to test Wilcox sands before plugging back and completing in the Sparta. It opens first production on the extreme south flank of the dome.

The discovery well of the Pecan Lake field, Cameron Parish, Superior Oil Co. of California 1-B Miami Corp., in 29-14s-3w, is being drilled deeper, and is going ahead below 11,482 ft.

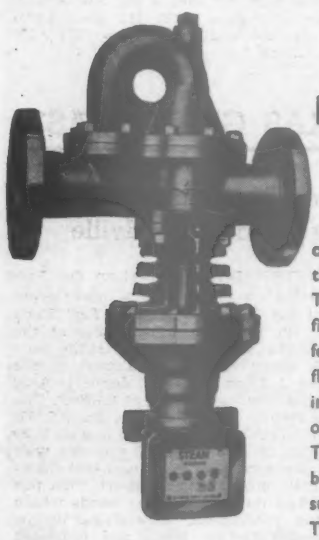
APPALACHIAN FIELD

Moving in Rotary for First Atlantic Seaboard Test

PITTSBURGH.—On the Delmarva Peninsula in Wicomico County, Maryland, The Ohio Oil Co. is moving in a rotary for the first Atlantic Seaboard test following the major leasing program of large companies. The location is about 6 miles east of Salisbury, on the Larry G. Hammond farm. Considerable seismograph work has been done over the area and the entire peninsula is practically under lease by major companies, notably Sinclair Prairie Oil Co., Pure Oil Co. and Ohio.

In Tucker County, West Virginia, Ohio discontinued deepening of the Oriskany test on the Kaemmerling tract on Blackwater anticline in Dry Fork district owing to an obstruction in the window of the casing at 7,500 ft. The total depth is 8,048 ft., which is 60 ft. below the top of the Oriskany sand. A string of tubing was run to bottom and perforated for 62 ft. The test showed 92,000 cu. ft. gas which will be used for drilling a second test in the vicinity.

In Pocatalico district, Putnam County, Cumberland Gas Co. shut down the Orikany test on Raymond City C & T Co. with Corniferous lime topped at 4,581 ft. and Oriskany sand at 4,687-4,725 ft., which is now being test.



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OHIO, KENTUCKY

Three Wells Completed in Sandyville Gas Field

COLUMBUS.—The Sandyville field had three widely scattered completions this week. East Ohio Gas Co. 1 H. H. Steinbach, Section 36, Perry Township, Stark County, shut in after shot at 861,000 cu. ft. Pay was in the white Clinton at 4,572-92 ft. Belden et al 1 B. B. Towner, Section 5, Pike Township, Stark County, was shot and completed at 900,000 cu. ft. from pay at 4,658-65 ft. The Natural Gas Co. of West Virginia completed a small well in N. V. Kenner, Lot 34, Sandy Township, Tuscarawas County. The well shut in at 240,000 cu. ft. from pay at 4,795-4,821 ft.

A 1,290,000 cu. ft. completion by the Ohio Fuel Gas Co. on the Harriss and Miller lease, Section 2, Washington Township, Holmes County, further extended to the east the old Washington pool. Sand was drilled from 2,968-3,004 ft.

A wildcat test to the Clinton sand will be started early in August by Harold C. Bishop on the 505-acre Dick farm, Richfield Township, Summitt County, northern Ohio. Operator expects the sand at about 3,700 ft. Acreage was acquired from East Ohio Gas Co.

OHIO WILDCAT COMPLETIONS

Jackson County, Jefferson Township: Proffitt & Duer 1 Mathew Fox, Sec. 25, Clinton 2,853-67 ft., Medina 2,956-76 ft., dry, TD 2,976 ft.

Wayne County, Chester Township: Ohio Fuel 1 W. H. Rutt, Sec. 15, Clinton 3,210-25 ft., dry, TD 3,286 ft.

Wooster Township: Ohio Fuel 1 W. C. Lytle, Sec. 18, Clinton 3,242-56 ft., dry, TD 3,287 ft.

WESTERN KENTUCKY

OWENSBORO.—Shell Oil Co. completed a 1,025-bbl. well in Levias lime at 2,524-38 ft., total depth 2,568 ft. in 1 M. Clements in 9-O-20, Union County. It had not been acidized and flowed naturally. It was the best well of the week in the state.

WESTERN KENTUCKY WILDCAT COMPLETIONS

Union County: Delta and Ashland 1 Goble-Buckman, SW NW NE 18-P-20, dry at 2,722 ft., lower Menard 1,816 ft., Cypress sand 2,292 ft., Ste. Genevieve 2,549 ft., McClosky 2,632 ft.

Sohio and B. F. Thompson 1 Sam Martin estate, 25-M-20, dry at 2,384 ft.: no log.

EASTERN KENTUCKY

ASHLAND.—Drilling operations displayed an uneven curve during the week with some idle wells in various fields. Several locations were made and two wells were drilled in.

Kentucky West Virginia Gas Co. completed well 5,525 on the S. B. Leslie tract on Long Beach of Sycamore Creek in Pike County at total depth of 3,314 ft. with a daily open flow of 133,000 cu. ft. of gas from shale after a shot. The same company completed well 5,528 on the R. C. Beverly land on Big Branch of Caney Fork in Knott County at total depth of 3,042 ft. The well has a daily open flow of 223,000 cu. ft. of gas from shale after a shot.

INDIANA

EVANSVILLE.—Cherry & Kidd and

Winston Brothers 1 V. R. Baird, SW SW NE 25-3s-12w, in Gibson County, found McClosky lime at 2,514-20 ft. and 2,525-26 ft., total depth 2,517 ft., was given a drill-stem test and developed a good gas showing and 1,230 ft. of clean oil with 90 ft. of oil-cut mud, but no water. It looks very promising for a new pool and new pay. It is 5 miles from other production. Two oil wells and five dry holes were completed in the state during the week.

INDIANA WILDCAT COMPLETION

Spencer County: Texas Co. 1 Paul Gogel, SW NW SW 25-4s-5w, dry at 2,521 ft. Tar Springs 517 ft., Glen Dean 589 ft., Barlow 754-62 ft., Ste. Genevieve 868 ft., Chattanooga 2,024 ft., Devonian 2,292 ft.

Posey County: Farm Bureau and Bert Redgrave 1 Graulich, SE SE NE 9-7s-13w, dry at 2,803 ft., Menard 1,814 ft., Barlow 2,350 ft., Renault 2,629 ft., Ste. Genevieve 2,676 ft., McClosky 2,715 ft.

KANSAS

50 Completions in 1 Week Marks New Record for Year

KANSAS operators broke all records for 1944 by completing 50 wells last week. There were 11 wildcat completions, only 1 of which was successful, the other 10 being dry. Among the field development wells, 26 oil wells were completed for potential initial production of 20,025 bbl., while there were 13 dry holes. There were 44 new locations made during the week, including 11 new wildcat starts, an increase of 3 wildcats and 1 field location over last week.

Four completions were given top potential of 3,000 bbl. per day, one each in the Carmi and Chitwood pools of Pratt County, one in the Zenith-Peace Creek pool of Reno County and one in the Ronson pool in Stafford County. The Chitwood pool also drew one completion with a potential of 1,750 bbl. The Barry pool in Rooks County had one completion with 1,166 bbl. potential, while the Hall-Gurney pool of Russell County had two completions rated at 1,605 and 1,732 bbl. respectively.

Of the 11 new wildcat locations, Pratt and Trego counties had 2 each, with 1 each being located in Butler, Ellsworth, Greenwood, McPherson, Norton, Osborn and Reno counties.

KANSAS WILDCAT COMPLETIONS

Barton County discovery: Derby Oil et al 1 Kruckenberg SE SE NW 13-19-15w, swabbed 1½ bbl. oil and ⅛ bbl. water per hr. for 13 hr., from Reagan pay zone 3,542-61 ft., TD 3,561 ft., base Kansas City 3,457 ft., conglomerate 3,500 ft., Reagan 3,541 ft., cherty conglomerate 3,541 ft.

Cowley County: Texas 1 Schwantes, NW NW SE 5-32-4e, dry, TD 3,500 ft., Arbuckle 3,484 ft.

Douglas County: Skelly Oil 2 Middlekauf, SW NE NE 21-13-19e, dry, TD 1,271 ft., Mississippi lime 1,267 ft.

Ford County: Texas 1 Andrews, NW NW SW 17-29-23w, dry, TD 6,485 ft., Arbuckle 6,370 ft.

Phillips County: Texas 1 Armstrong, SE SE SW 2-5-18w, dry, TD 3,490 ft., Arbuckle 3,448 ft.

Rice County: J. W. Davisson 1 Stout, SW SE SW 8-21s-9w, dry, TD 3,425 ft., Arbuckle 3,387 ft.

Lion Oil & Refining 1 Green, NE NE NE 7-24-8w, dry, TD 4,227 ft., Arbuckle 4,172 ft.

Russell County: H. K. Porter 1 Eulert, NW NW NE 26-11-15w, dry, TD 3,422 ft., Arbuckle 3,420 ft.

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Saline County: Phillips Petroleum 1 Swan, NE NE NW 7-15-1w, dry, TD 3,481 ft., Arbuckle 3,451 ft.

Sedgwick County: Sohio Petroleum 1 Limebur, NE SE SW 21-27-3w, dry, TD 4,285 ft., Arbuckle 4,265 ft.

Sheridan County: Derby Oil 1 Flagler, NE NE NE 7-8-26w, dry, TD 4,870 ft., Arbuckle 4,812 ft.

CANADIAN FIELDS

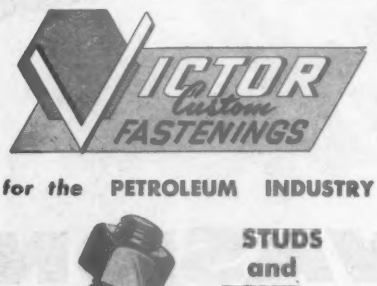
Important Turner Valley Extension Indicated

CHATHAM, Ont. — An important southerly extension of Turner Valley, previously thought cut off from production by faulting, is indicated by Imperial-Turner Valley 1, LSD 5, 9-18-2w5. This well finished at 7,638 ft. with Madison at 7,143 ft. to produce 33 bbl. an hour after its first acid wash, stepped up to 57 bbl. after the second. Gas-oil ratio is around 4,500.

Pinhorn dome. — McColl - Frontenac 2, LSD 9, 17-1-8w4, just north of the Montana boundary, is testing encouraging oil shows at 3,288 ft.

Aldersyde.—New Ranchmen's-Snyder 1, LSD 16, 34-19-29w4, finished in the lime at 7,911 ft. without finding commercial production. Oil and gas shows were encountered and further drilling will be undertaken.

Conrad.—Conrad-Province 2, LSD 1, 5-6-15w4, after swabbing 80 bbl. daily from the Ellis at 2,960-72 ft. is being put on the pump, with production between 100 and 200 bbl. of 25-gravity crude expected.



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ILLINOIS

Wildcatters Open or Extend Pools in Five Counties

CENTRALIA.—A wildcat starting at 285 bbl. per day from McClosky lime extends the Schnell pool in Richland County. An outpost in 31-1n-10e, in Edwards County, opened with a production of 127 bbl. per day, with 67 bbl. of water. Wildcats in Gallatin and Jefferson counties were showing favorably. Nine of 11 wildcat completions were dry. Leach, Swann et al 2 Goforth, SE SE SW 27-7s-10e, Gallatin County, flowed about 16 bbl. per hour while being cleaned out after a shot in Tar Springs sand at 2,094-2,122 ft. It is 3 miles from any oil pool. The Texas Co. 1 Kasban, SE SE NW 8-2s-1e, Jefferson County, is showing production in Benoist and Roseclaire formations. It is 2 miles from other oil wells.

Forty-six new operations were reported during the week, including the following wildcats: W. R. Gross 1 Danly, NW NW NE 24-5n-10e, Jasper County; Allied Oil Corp. 1 Dunn, 2,550 ft. from south and 2,600 ft. from west lines, SW 11-3s-14w, and Sohio Petroleum Co. 1 R. E. Pearce, SE NW SE 3-7s-10e, White County; H. Luttrell 1 D. F. Featherling, NE SE NW 21-1s-9e, Wayne County; Frontier F. O. Corp., 1 M. S. Lacy, NE NW NW 9-4n-4e, Marion County; Neal Thompson 1 V. E. Stephens, SE SE NE 30-3s-4e, Jefferson County; H. J. Schlafly 1 Baldwin-Howe, NE SE NW 32-5s-3e, Franklin County; Ohio Oil 1 U. S. C. & C. Co., SW SE NW 3-6s-4e, Franklin County; T. M. Conry 1 J. H. Welde, NE NE SE 16-4n-2w, Bond County; B. M. Heath et al 1 Farmer, SW NE SE 18-7s-8e, Gallatin County.

ILLINOIS WILDCAT COMPLETIONS

Clay County: W. H. Krohn 1 Smith, SE SE SE 10-4n-5e, dry at 2,706 ft., Glen Dean 2,128 ft., Cypress 2,337 ft., Benoist 2,474 ft., Aux Vases 2,542 ft., Ste. Genevieve 2,571 ft.

National Associated 1-A J. Hunley, SE SW SW 8-3n-8e, swabbed from 7 to 17 bbl., of oil per day, from McClosky lime at 3,026-38 ft., but produced much salt water with the oil, TD 3,100 ft.

Edwards County: Redwine et al 1 G. C. Jones, SE NW NE 31-1n-10e, pumped 132 bbl. of oil and 67 bbl. water, McClosky lime 3,238-45 ft., acidized, TD 3,253 ft.

Fayette County: A. J. Hammer 1 D. E. Diepert, SE NE NW 23-5n-4e, dry at 2,570 ft., Tar Springs 1,982 ft., Cypress 2,290 ft., Benoist 2,356 ft., Aux Vases 2,436 ft., McClosky 2,516 ft.

Franklin County: Sohio 1 E. F. Webb estate, SE SW SE 17-5s-4e, dry at 3,252 ft., Menard 2,226 ft., Hardinsburg 2,512 ft., Cypress 2,768 ft., Benoist 2,964 ft., Aux Vases 3,022 ft.

Henderson County: Northern Ordnance 1 F. Bohan, SW NW SE 18-8n-4w, of fourth principal meridian, dry at 725 ft.; no log.

Perry County: Ohio Oil 1 Suchomski, NE NE SW 5-4s-2w, dry at 1,444 ft., Menard 849 ft., Barlow 1,205 ft., Benoist 1,393-1,434 ft.

Richland County: Pure Oil 1 W. L. McBride, SW SE SE 16-3n-9e, dry at 3,060 ft., Menard 2,176 ft., Cypress 2,648 ft., Aux Vases 2,903 ft., McClosky 2,980 ft.

Pure Oil 1 C. T. Smith A, SW SE SE 35-3n-8e, 286 bbl. in 24 hours, McClosky lime a 2,968-76 ft., TD 3,002 ft. Extends Schnell pool.

Wabash County: Fox Bros. 1 Woodyard estate, NE SE SE 33-2s-13w, dry at 2,794 ft., Menard 1,933 ft., Cypress 2,429 ft., Aux Vases 2,711 ft., McClosky 2,789 ft.

Wayne County: Burr Lambert 1 Faverty, NE SW NE 2-1n-6e, dry at 3,311 ft., Menard 2,430 ft., Cypress 2,852 ft., Aux Vases 3,178 ft., McClosky 3,248 ft., St. Louis 3,308 ft.

OKLAHOMA

New Starts Outnumber Completions Almost 2 to 1

THE optimism of Oklahoma operators is again reflected in this week's figures showing 48 new wells started during the week compared to 26 completions. New wildcats started totaled 9 against 8 completions, while 48 new field wells started compared to 18 completed.

The wildcat starts were scattered throughout the state with one each in Carter, Creek, Grady, Jefferson, Logan, Noble, Pawnee, Pottawatomie and Washita counties.

Four of this week's completions were in West Edmond, which continues to dominate the scene, and two of the four were classified as extensions. Twenty-two new locations were announced in the field this week, 19 by Phillips Petroleum Co., which brings that company's total active and projected operations to 50. The field now has 91 oil wells officially completed, 6 dry holes, and 70 wells drilling, of which 10 are testing or waiting on cement. There are a total of about 100 locations, classified as "locations," "cellar and pits dug," "derrick on ground," "rig material moving in," "waiting on drilling crew," and "waiting on contractor," but the most numerous of the group is "waiting on contractor."

In the Cement field, the Little Nick Oil Co. 4 Rigney, SW SE NW 12-5n-9w, blew out from a sand at 5,490-92 ft., when the drilling crew had pulled pipe about 10 ft off bottom, blowing an estimated 50,000,000 cu. ft. of gas per day.

OKLAHOMA WILDCAT COMPLETIONS

Carter County discovery: Pure Oil 1 Taylor, NW SW 26-3s-1e, flowed 249 bbl. in 24 hr., flowed 551 bbl. oil and 50 bbl. water in 24 hr., 306 bbl. oil and 99 bbl. water, 249 bbl. oil and 100 bbl. water, 251 bbl. oil and 123 bbl. water, through 1-in. tubing choke, CP 400 lb., TP 260 lb., TD 5,371 ft., pay zone 5,346-71 ft., Viola 4,077 ft., Simpson dense 4,795 ft., Simpson first sand 5,155 ft.

Kay County: Pure Oil 1 Phelps, SE SW NW 19-26n-1e, dry, TD 4,410 ft., Arbuckle 4,238 ft.

Oklahoma County, West Edmond extension: Phillips Petroleum 1 Gomer Smith, SW NW 16-14n-4w, flowed 389 bbl. in 23 hr. after acidizing with 3,000 gal., TD 6,746 ft., Woodford 6,620 ft., Hunton top 6,660 ft., base Bois d'Arc 6,730 ft.

West Edmond extension: Phillips Petroleum 1 Coder, SE NE 9-14n-4w, flowed 1,148 bbl. through ½-in. tubing choke, CP 500 lb., TP 120 lb., TD 6,718 ft., Woodford 6,540 ft., Hunton top 6,586 ft., base Bois d'Arc 6,638 ft.

Okfuskee County: Wilcox Oil & Gas 1 Fulson "A," NW NW NW 15-12n-10e, dry, TD 3,742 ft., second Wilcox 3,695 ft.

Osage County: Moobla Drilling et al 1, SW SW SW 15-25n-7e, dry, TD 2,710 ft., Mississippi chat 2,675 ft.

Pontotoc County discovery: J. L. Shaw 1 Jackson, NE NE SW 32-5n-6e, pumped 25 bbl. 27° gravity oil from second Cromwell sand at 1,913-40 ft., TD 2,925 ft., PB, TD 1,940 ft., second Cromwell 1,915 ft., Woodford 2,565 ft., Hunton 2,735 ft., Sylvan 2,910 ft.

Stephens County: Pace et al 1 Hall, SE SW NW 26-2s-7w, dry, TD 1,910 ft.

Possible Future Oil Pools of Pennsylvania

(Continued from page 130)

folds apparently subjected to as much horizontal compression as western Pennsylvania. Another fact indicating probable deep porosity is that unconformities are known to be associated with some of the deep limestones here and such unconformities, as shown in the Mid-Continent, are major causes of limestone porosity. Finally direct evidence of porosity in the deeper horizons is supplied by wells which have penetrated them in parts of western Pennsylvania and eastern Ohio, in that flows of water or gas have been encountered.

Lockport Comparable to Permian

The Lockport, or Newburg, is a deep horizon of possibilities although it has thus far proved discouraging. This is a granular, porous, dolomite in the Niagara limestone. It has produced commercial oil in Kentucky and gas with minor quantities of oil in Ohio. Salt water, gas and shows of oil are reported from it in several wells of Crawford, Mercer and adjoining portions of Northwest Pennsylvania. Further southeast very few wells have drilled deep enough to penetrate it. The Lockport is about 250 ft. thick and lies about 400 to 500 ft. above the Medina. Consideration of Lockport possibilities is not complete, I think, without mention of the fact that its stratigraphic setting is comparable in many respects with the prolific Permian dolomites of West Texas and southeastern New Mexico. In these latter areas thick deposits of red shale, salt, anhydrite and other evaporites are underlain by limestones and dolomites. The production is largely from porous zones in granular dolomite and limestone. The stratigraphy is very complex. Massive reefs occur in the limestone and many of the pools lie above, in or on the side of these reefs. Other pools are apparently unrelated to reefs. Large folds are not necessary to the pools and some, like the Slaughter pool, occur where the regional dip is almost undisturbed. At Slaughter the porous zones in the dolomite evidenced little beyond shows of oil with water until cored, acidized and the water shut off when they turned into one of our great oil fields. Similarly, possibly, the Niagaran limestones and dolomites, with their porous zones and scattered indications of oil and gas, lie below the Salina salt and anhydrites and reefs are common in them.

The Medina, like the Oriskany, is a great source of gas, with some oil, in western New York and Central Ohio. Shows of gas have been encountered in it at several widely scattered localities in western Pennsylvania. It has generally been thought to underlie all western Pennsylvania but it is probably a series of sand lenses and porosity lenses, rather than a continuous sheet sand and locally is absent, as in parts of eastern Mercer County. Structure will not suffice, therefore, in selecting favorable places to prospect it. Like the Oriskany, it is generally considered more likely to yield gas than oil and this is corroborated by the few wells that have penetrated it. The Medina lies about 6,000 ft. below sea level—a drilling depth of 7,000 to 8,000 ft.—along a northeasterly line extending from Tioga County to southern Beaver County. Northwest from this line its depth decreases rapidly to about 3,000 ft. at Lake Erie. Southeast from this line its depth increases to a probable maximum of about 11,000 to 12,000 ft.

The Ordovician, lying below the Medina, is a great system of marine sedimentary rocks which few wells in Pennsylvania have reached and none have completely penetrated. It contains several horizons of possible production, notably the Trenton limestone, the St. Peter and other sands or sandy zones and the very deep Beekmantown limetone. The only well in the state which penetrated deeply into these rocks is the Ohio Oil Co. well in western Erie County which reached the St. Peter sand at 5,179 ft. and continued in this sand to total depth of 5,191 ft. Except as revealed by this well and a few others which have penetrated less deeply into it the Ordovician rocks of Pennsylvania are known only on their outcrop in the central part of the state. What lies under the plateau — between these points where these rocks are known —is a fruitful field for conjecture.

Trenton Merits Consideration

The Trenton has produced commercial oil with some gas in Northwest Ohio where it is dolomitic and some production has been found in it in Kentucky. In central New York it has produced some gas but is generally not dolomitic there and is very low in porosity. In the Ohio Oil Co. well of Erie County it was encountered at 4,437 ft., was slightly dolomitic in the upper part and had an oil show of about 1 bbl. per day. Present data necessitate continuing to consider it as a possible horizon of commercial production in Pennsylvania but it does not look promising. It lies 3,000 ft. below the top of the Medina at its outcrop near Bellefonte in central Pennsylvania but this interval has decreased to about 1,800 ft. in Erie County. It is, then, within reasonable drilling depths—say 4,500 to 9,000 ft.—throughout large parts of northwestern Pennsylvania. In reaching it there exists the possibility of encountering production from a porosity pinchout as the section between it and the Medina decreases updip.

The St. Peter sand lies about 750 ft. below the top of the Trenton in Erie County. It is fine to medium-grained gray to white sand. Several wells in northeastern Ohio have penetrated it and generally encountered copious water. In the Erie County well mentioned above it contained a show of gas and of oil and a little salt water. In central Pennsylvania it is apparently absent by unconformity.

Beekmantown Unexplored

The Beekmantown is a massive, cherty dolomite. At Bellefonte, in the central part of the state, it lies about 1,200 ft. below the top of the Trenton, is about 4,000 ft. thick, contains a bed of sand about 1,200 ft. below its top, and is unconformably overlain by the thin-bedded, blue Carlim limestone. No wells in Pennsylvania have reached it. The total thickness of the Ordovician decreases from about 8,000 ft. at Bellefonte to about 1,500 at Rochester, N. Y. This is a northward decrease of 6,500 ft. in 150 miles—an average pinchout rate of about 40 ft. per mile. Thinning at a lower average rate occurs westerly and northeasterly from central Pennsylvania into Ohio. This thinning is partly, at least, the result of unconformities.

Present data are entirely too meager to draw conclusions regarding the possibilities of deep Ordovician horizons beyond the general statement that they undoubtedly do have possibilities. These possibilities are better visualized, perhaps, by noting that the Ordovician of Pennsylvania is stratigraphically and, probably, structurally comparable with Mid-Continent rocks of the same age. The Trenton is essentially the equivalent of the Viola limestone of Oklahoma. The Viola is a minor oil-producing horizon as is the Trenton. Below the Viola are the Simpson beds in which occurs the prolific Wilcox sand. The Wilcox is similar in lithology and probably the approximate time equivalent of the St. Peter.

Unconformably underlying the Simpson beds is the massive, cherty Arbuckle dolomite of Oklahoma or the Ellenburger of Texas.

These are the approximate time equivalents and strikingly similar in general lithology to the Beekmantown, which is also separated from younger beds by an unconformity. The Arbuckle and Ellen-

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burger are important oil-producing horizons in several pools — both structural and stratigraphic — from Kansas to West Texas. The Ordovician rocks are deep in the Mid-Continent as they are in Pennsylvania. Many other deep pools producing oil from them could be mentioned, and should be carefully studied along with study of Pennsylvania Ordovician possibilities, but it is more noteworthy, perhaps, that, although dry, the objective of the deepest well in the world, Phillips Petroleum Co. 1 Price, in Pecos County, Texas, was the Ellenburger which was topped at 15,075 ft. Also noteworthy is the fact that drilling to the Ordovician in the Mid-Continent revealed that fault blocks had raised these beds to reasonable depths at numerous places. The fault blocks had been periodically raised, eroded, buried and raised again and were eventually completely buried under Pennsylvanian and later rocks. It was learned that slight folds in the surface rocks—no larger than many folds in northwestern Pennsylvania — overlie these blocks and assist in locating the pools. Within recent years it has been learned that many of the plateau structures of Pennsylvania are underlain by complex fault blocks. High angle faults of about 1,000 ft. displacement occur at the Oriskany horizon in the Summit pool and similar faults are known in many places under the stronger folds of the plateau. Much is left to learn regarding these faults and other features of the deep structures, but it seems probable that if fault blocks of 1,000-ft. displacement occur at the Oriskany horizon under strong folds like Chestnut Ridge, similar blocks may occur in the Ordovician under the more gentle folds of the plateau, especially when it is known that Oklahoma City, Garber and other Mid-Continent fault blocks underlie little disturbed surface beds. The Taconic disturbance at the end of the Ordovician may well have affected western Pennsylvania more than is known. One must not, of course, jump to the conclusion that the Ordovician of Pennsylvania contains pools of the character and magnitude of those of the Mid-Continent but neither should it be hastily dismissed and thereby overlook the clue to the answer.

It is probably idle to carry these conjectures lower than the Beekmantown. Many shallow and deep possibilities of additional pools have been mentioned. Upon further investigation some, but not all, of these can probably be disproved without further drilling. Wallace Pratt, in his recent book "Oil in the Earth" concludes that oil is a normal constituent of marine sedimentary rocks all over the earth and

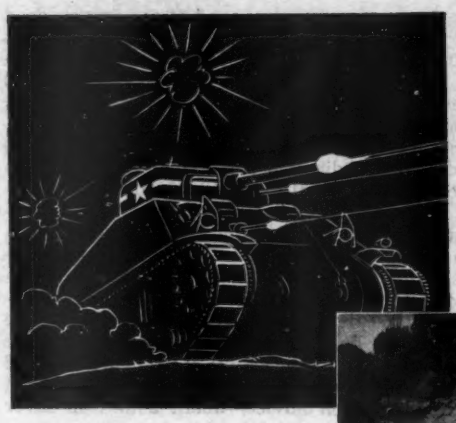
that, when thoroughly explored, 1 to 2 per cent of the total area of the reasonably favorable sedimentary basin will yield oil commercially. He considers Pennsylvania throughly explored in the shallow horizons and considers complete exploration to be a well density of about one dry hole to 1 sq. mile. If one dry hole per square mile is complete exploration, Pennsylvania has long since been completely explored for shallow horizons in, immediately adjoining and between the present pools. It is only partly explored in the shallow horizons northwest and southeast of these pools and in the Oriskany and is almost unexplored below the Onondaga.

Possibility of Discovering New Pools

Assuming that the prospects are favorable and that undiscovered pools exist in Pennsylvania, the question has also been asked as to the possibility of finding these pools through wildcatting. One wildcat may discover a pool but one dry hole truly condemns only a few square feet or few acres to the depth of its penetration.

The first statistical consideration is a table by Pratt, in his book, "Oil in the Earth," showing the number of dry holes drilled in the United States for each major oil field discovered. The average from 1920 to 1940 is about 500 dry holes per major pool; 690 dry holes per major pool were required in 1920-22. This is the highest in the 20-year period. In 1934-36 only 220, the lowest in the 20-year period, were required, while 1938-40 required 640. Several times in this 20-year period it seemed that few, if any, more major pools would be found in the nation and alarm was expressed but persistent, intelligent wildcatting proved otherwise. Interesting in this connection is a statement in The Oil and Gas Journal, May 4, 1944, by W. C. Morse, Mississippi state geologist, that it required "more than a third of a century of search (and) more than 460 wells drilled" to discover the first oil field of Mississippi. Of these 260 were outside the Jackson gas field. In 2 years after its discovery, the first field, Tinsley, had 242 producing wells. The clear inference of these statistics is that dry holes into the hundreds are required to discover major oil fields even where conditions are definitely favorable as later proved. However favorable the possibilities of Pennsylvania may be we must be prepared to accept dry holes in large numbers.

The above statistics apply to major pools. Let us now consider the chances that wells drilled will be commercially productive of oil, gas or distillate even though they do not open major pools. Statistics as-



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sembled by The Oil and Gas Journal from 21 states and quoted in the June 8 Oil City Weekly Derrick show that 1,241 wildcats were drilled up to May 13 this year. Of these 15.6 per cent were producers —4.1 per cent producers of natural gas or distillate and 11.5 per cent of oil. This percentage of producers to total wildcats compares very favorably with the records of recent years as published by Lahee. In 1939, 10.4 per cent of the wildcats were producers, in 1940 12.5 per cent, in 1941 15.4 per cent and in 1942 16.3 per cent. If, then, Pennsylvania prospects are as favorable as the average of the other oil states has been since 1938—a very doubtful assumption — and if we use as good judgment and technical advice as are used ordinarily elsewhere, we may reasonably expect from 10 to 15 per cent of our wildcats to be commercially productive. An average significantly lower than this is indication something is wrong.

Finally, let us consider statistically the advisability of collecting samples and bothering with geological, geophysical or other technical assistance in any wildcat program undertaken. Again quoting Lahee's statistics, in 1939, 13 per cent of the holes located on technical advice were successful as compared with 6 per cent of those located without such advice—about 2 to 1 in favor of technical advice. In 1940 it was 15.6 per cent successful with technical advice as compared with 4.2 per cent without such advice—over 3 to 1. In 1941 it was 19.5 per cent successful with technical advice, 3.7 per cent without—5 to 1, and in 1942, the last year for which statistics are available, it was 18.3 per cent successful with 4.9 per cent without technical advice—4 to 1.

Summary

Summarizing the over-all possibilities of Pennsylvania it seems that there are so many different possible areas and horizons in which undiscovered oil pools may lie that they add up to a strong probability that at least some such pools are here. The attempt has been made to avoid glossing over any facts or concepts contrary to favorable possibilities, but in the attempt at indicating possibilities it is difficult to avoid making conditions appear more favorable than they are. We would probably be too optimistic should we suppose that the average chances here are better, or even as good, as has been the average chance in other oil-producing states during the past 20 years. Therefore, if you drill 500 wildcat wells, utilizing technical advice to the average extent that has been done elsewhere you have no reason to expect better results than about 425 dry holes and 75 commercially productive wells, one of which may be the discovery well to a major pool. If you do not fully utilize the information from each well in telling where to locate the next and use other technical assistance your chances of success are about one-fourth as good as if you do.

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The above equipment will be sold in accordance with War Production Board and Office of Price Administration regulations, and free from all incumbrances. Payment shall be made within 10 days from date of sale by cashier's or certified check, payable to the Tennessee Valley Authority. Material may be removed immediately upon payment and must be removed within 30 days from date of sale.

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LEGAL

Notice of Oil & Gas lease sale: The U.S. Department of Agriculture will award leases on 15 tracts of approximately 2480 acres in Cochran County, Texas, on former Slaughter Ranch. Rent $1.00 per acre. Awards limited to 1 tract per lessee. Sealed bids to be publicly opened September 15. Bid forms and additional information can be secured from Ray E. Davis, Acting Regional Director, Farm Security Administration, Old Post Office Building, Amarillo, Texas. Permission may be obtained from Mr. Davis for making preliminary geophysical and geological surveys upon written request.

MISSISSIPPI

Humble to Make Third Try At Adams County Wildcat

JACKSON, Miss.—Humble Oil & Refining Co. evidently thinks highly of their prospect in Adams County, which some geologists believe lies on a trend that will extend from the Lake St. John pool in Louisiana to the Cranfield pool in Mississippi. Humble's wildcat, 1 Ida Stowers, 9-8n-2w (irregular section), has had rig skidded for a third try, after being dogged by bad luck. The first hole reached 7,701 ft., when mechanical difficulties made further deepening impossible. The hole was sidetracked at 1,863 ft., and redrilled to 8,729 ft., where a twistoff resulted in a junked hole. Now the rig is being skidded 50 ft. to the northeast.

Active operations continue to increase steadily and the past week was no exception, as after completing 4 producers in the Heidelberg pool and two in the Eucutta pool, plus 3 dry wildcats, 14 new operations were announced, 7 for the Heidelberg pool, 1 for the Cranfield pool, 1 semiwildcat in Heidelberg and 5 other wildcats.

In Alabama, H. L. Hunt 2 Robert Land, a wildcat, reached a total depth of 5,280 ft., ran electric log, plugged back to 3,670 ft., set pipe at 3,600 ft., and is waiting on cement. Hunt's 1 Land, a south offset to the present well, was drilled last December and it was reported that shows of heavy black oil were encountered in the upper Eutaw topped at 3,170 ft.

MISSISSIPPI WILDCAT COMPLETIONS

Adams County: Humble 1 Ida Stowers, 9-8n-2w (irreg. section), dry, TD 8,729 ft., hole junked. Cook Mt. 2,251 ft., Sparta 2,576 ft., Tallahatta 3,685 ft., Wilcox 3,860 ft., Midway 7,054 ft., Selma 7,689 ft. Original role reached 7,701 ft., sidetracked at 1,863 ft., redrilled to 8,729 ft., twisted off, junked.

Jasper County: Angle & Angle 1 Masonite Corp., SW SW 31-3n-11e, dry, TD 6,081 ft., chalk 4,031 ft., Eutaw 5,181 ft., Tuscaloosa 5,716 ft.

Smith County: W. C. Goldston-Fohs Oil 1 Smith County Oil Co., in SW SW 30-3n-8e, dry, TD 8,085 ft., Wilcox 2,065 ft., Midway 4,729 ft., Selma 5,411 ft., Eutaw 6,930 ft., Tuscaloosa 7,542 ft., Massive sand 7,780 ft.

ALABAMA WILDCAT COMPLETIONS

Bullock County: T. M. McLennon 1 Bullock, SE SW 18-12-22e, dry, TD 1,020 ft., top Selma 176 ft.

Washington County: Humble 1 Williams, SE SW 16-6s-4w, dry, TD 7,550 ft.

GEORGIA WILDCAT COMPLETION

Clinch County: Hunt Oil 2 Alice Musgrove, Lot 485, Land Dist. 12, dry, TD 3,312 ft.

LEGAL

UNITED STATES DEPARTMENT OF AGRICULTURE, Farm Security Administration, Dallas, Texas, July 17, 1944. Sealed bids in duplicate will be received until 3:00 o'clock P.M. (cwt), August 17, 1944, and then publicly opened, offering bonus for operating rights in connection with gas and oil leases on land located at McAllen, Hidalgo County, Texas, consisting of two tracts of land containing 99.394 acres. Award of lease will be made only to bidder who can show sufficient experience and financial resources and prove citizenship. Interested parties may obtain bid documents from the Regional Business Manager, Farm Security Administration, Parry Avenue at Commerce, Dallas, Texas.

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LA.-ARK.

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MAGNOLIA, Ark.—Midstates Oil Co. 1 Taylor-Waller-Stevens unit, 401 ft. south and 554 ft. west of center 4-20s-20w, Haynesville Extension pool, flowed 1,020 bbl. from pay zones at 5,424-36 and 5,480-92 ft., to make the best completion of the week in either Arkansas or North Louisiana.

Arkansas operators completed a total of six oil wells and one dry hole, among which there were no wildcats, and started seven new wells during the week. Completions included a 25-bbl. well in the Troy pool, a 175-bbl. well in the Fouke pool, a 192-bbl. well in the Patton pool, and one completion each in Dorcheat and Macedonia, in addition to the Haynesville Extension well. The dry hole was in the old Smackover area.

NORTH LOUISIANA WILDCAT COMPLETIONS

Caldwell Parish: Northern Ordnance 1 McMullen, SE NW 20-13n-2e, dry, TD 9,742 ft.

Winn Parish: H. L. Hunt 1 Mansfield Lumber Co., SE SW 5-12n-4w, dry, TD 6,114 ft.

North Louisiana operators completed two oil wells, one gas well and three dry holes. Two of the dry holes were wildcats; H. L. Hunt's 1 Mansfield Lumber Co., SE SW 5-12n-4w, in Winn Parish, northeast of the old Calvin pool, and Northern Ordnance 1 McMullen, SE NW 20-13n-2e, about 20 miles north of the old Urania pool. The oil completions were in the White Sulphur Springs and Holly Ridge pools, good for 100 and 330 bbl., respectively. Five new locations were made during the week, including one wildcat, Chicago Mill & Lumber A-1 Mutual, SW NE 30-12n-10e, Tensas Parish.

SOUTHWEST TEXAS

Humble Test Drilling Ahead Following Oil Showing

CORPUS CHRISTI.—Humble Oil & Refining Co. 2 Joseph F. Green estate, in T. T. Williamson Survey, 2,640 ft. northeast of 1 Green, the discovey well of Gregory field, San Patricio County, is drilling at 9,047 ft. in shale, after showing oil on drill-stem tests at 8,305-12 ft. and 8,499-8,505 ft.

Pure Oil Co. 1-A Yturria Land & Livestock Co., on Lot 25, Santa Isabel Grant, 400 ft. southeast of the 1 Yturria cratered hole, 5 miles southwest of Port Isabel, cleaned up the fish job at total depth of 9,006 ft., and is drilling ahead below 9,240 ft.

H. H. Howell 1 Mallard, in Los Presenos Grant, east offset to his 1 Spoonts, discovery well about a mile northwest of North Magnolia City field, Jim Wells County is drilling below 5,120 ft.

A new location in the recently discovered Pridham Lake field, Victoria County, is Crown Central Petroleum Corp. 1 Riverside Cotton Farms, Inc., in Victoria Town Grant, 2 miles southwest of Victoria. This is an easterly offset to Kingwood Oil Co. 1 Wilden, discovery well of the field.

SOUTHWEST TEXAS WILDCAT COMPLETIONS

Brooks County: Sun 3-A Chas. Boedeker-State, R. Guzman Sur. 16, 16 mi. S of Falfurrias, 1,072,000 cu. ft. gas, with spray of condensate through 5/32-in. choke., perf 6,160-67 ft., TP 2,140 lb. CP 2,340 lb. TD 7,235 ft. Discovery.

Duval County: Harvey & Henderson 1 J. F. Welder estate, Samuel Alexander Sur. 102 no perforations, 62.48 bbl. day pumping, TD 2,076 ft.

Jim Hogg County: Harrison & Daubert 2 W. H. Stroman, El Sordo Grant, 13 mi. SW of Hebbronville area, dry at 3,759 ft.

Jim Wells County: Palmer Oil Corp. 1 Dora Lee Blake, L. Trinidad Grant, 5 mi. SW of Ben Bolt, dry at 5,930 ft.

Kenedy County: Humble 1 Charles M. Armstrong La Barreta Grant, 1¼ mi. E of Armstrong, dry at 8,507 ft.

Live Oak County: Henderson Coquat 1 T. E. Nelson, Guadalupe Braba Sur. 28, 7 mi. NE of Fant City, dry at 7,015 ft.

Nueces County: Tom Graham 1 H. P. Wagner Unit 3, Driscoll Ranch, 3 mi. NE of Banquette, dry at 7,350 ft.

Refugio County: J. C. Wynne et al 1 J. Zarsky, Antonio De La Vina Sur., 2 mi. E of Woodsboro dry at 6,515 ft.

San Patricio County: Southern Minerals Corp. 1 C. O. Watson, Sec. 46, Geo. H. Pauls subdivision of Welder Ranch, 4 mi. NW of Edroy, dry at 6,512 ft.

Starr County: Humble 1 R. E. Margo et ux, HE&WT Sur., 11 mi. N of Roma, dry at 5,029 ft.

Victoria County: Kingwood Oil Co. 1 Mrs. Addie Wilden,, Victoria 4-Lg. town grant in Blk. 1, 2 mi. SW of Victoria 107.60 bbl. through 9/64-in. choke, perf. 4,770-74 ft., gas-oil ratio 400, TP 500 lb., CP 400 lb., TP 4,907 ft. Victoria discovery.

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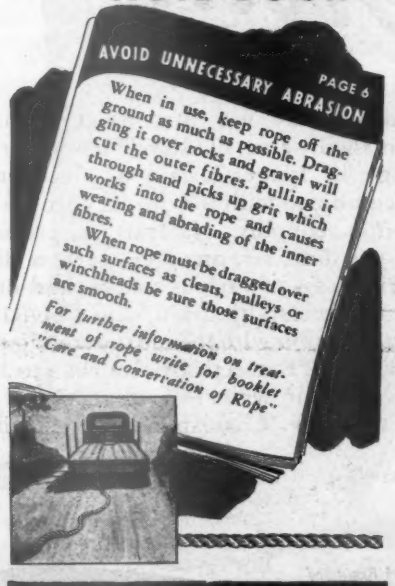
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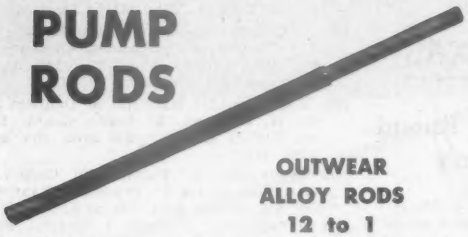

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Adapted for any use that other granular desiccants will serve, FLORITE has a marked advantage in longer-sustained effectiveness which, combined with low initial cost, results in superior economy. Natural gas, propane, butane, gasoline, air, nitrogen, carbon dioxide, refrigerants of various nature, and other fluids are successfully dried with FLORITE, and in connection with the most exacting processes. FLORITE selectively absorbs 4 to 20% of its weight of water — is regenerated by heating to 350°F. Correspondence is invited.

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FLORIDIN COMPANY, INC.

ADSORBENTS

Dept. A, 53 Liberty Street Warren, Pa.

SUMMARY OF JUNE COMPLETIONS*

	Total comp.	Oil	Prod.	Gas	Dry	Under 1,000 ft.	1,000-2,500	2,500-5,000	5,000 10,000	Over 10,000	Total footage	Rigs and drlg.
N. Y., Penna., W. Va.	†656	238	390	175	243	5	370	81	0	0	866,411	502
Ohio	68	12	213	33	23	8	25	35	0	0	172,140	197
Indiana	17	6	289	0	11	3	11	3	0	0	32,684	43
Kentucky	94	39	5,388	29	26	18	54	22	0	0	179,258	170
Michigan	66	15	1,482	15	36	2	39	24	1	0	146,775	133
Illinois	174	111	12,131	0	63	4	44	126	0	0	470,376	231
Kansas	202	98	31,106	6	98	0	21	180	1	0	587,430	279
Missouri-Iowa, Nebraska	1	0	0	1	0	1	0	0	0	0	200	9
Oklahoma	183	101	61,773	19	63	6	51	67	58	1	708,131	500
Texas:												
North Texas	59	27	5,383	0	32	6	21	13	19	0	198,838	236
West Central Texas	35	14	1,515	2	19	9	13	13	0	0	70,794	29
West Texas	116	86	41,425	3	27	0	13	47	51	5	561,399	464
Texas Panhandle	19	17	3,212	1	1	0	1	18	0	0	58,635	114
Eastern Texas	26	14	3,203	2	10	0	1	10	15	0	132,492	77
Upper Gulf Coast	88	49	11,407	9	30	0	2	7	70	9	661,084	93
Lower Gulf Coast	78	53	7,890	8	17	0	0	12	62	4	527,518	117
S. Central, San Antonio	13	7	425	1	5	1	5	4	3	0	42,453	9
South Texas, Laredo	54	21	2,155	4	29	0	11	23	20	0	220,600	56
Total Texas	488	288	76,412	30	170	16	67	147	240	18	2,473,813	1,195
Louisiana:												
North Louisiana	34	15	3,454	3	16	1	7	10	15	1	159,079	55
South Louisiana	45	30	7,827	1	14	0	0	3	20	22	418,050	97
Total Louisiana	79	45	11,281	4	30	1	7	13	35	23	577,129	152
Arkansas	24	16	3,511	0	8	0	1	6	17	0	156,954	39
Mississippi	12	7	2,410	0	5	0	1	2	7	2	69,422	56
Alabama, Georgia, Fla.	2	0	0	0	2	0	0	0	2	0	10,730	18
Montana	45	24	1,348	8	13	2	24	18	1	0	113,690	103
Wyoming	17	13	8,087	1	3	2	0	9	6	0	75,023	96
Colorado-Utah	2	1	563	0	1	0	0	1	1	0	9,610	31
California	182	136	19,325	2	44	3	54	90	30	5	664,733	229
New Mexico	33	27	4,269	0	6	4	7	21	1	0	96,811	100
Total June	†2,345	1,177	243,183	323	†845	75	776	845	400	49	7,511,320	4,074
Total May	‡1,903	1,034	228,997	169	‡700	102	708	724	336	33	6,515,068	3,758

*Five weeks ending July 1, 1944. †Includes 200 service wells. ‡Includes 175 service wells.

Gulf Posts Initial Prices In Hager-Martin Pool

NEW ORLEANS.—Gulf Refining Co. has posted prices for crude in the Hager-Martin pool, St. Martin Parish—first posting for the field—retroactive to June 1. The schedule begins at 90 cents a barrel for 20-gravity and below, with a 2-cent differential upward for each degree of gravity to a top of $1.30 for 40-gravity and above. The pool was opened by Gulf's 1 St. Martin, in 21-9s-7e.

Texas Allowable for August Fixed at 2,101,382 Bbl.

AUSTIN. — A crude-oil schedule for August calculated to yield 2,101,382 bbl. daily was announced last week by the Texas Railroad Commission. The average daily allowable was set at 2,271,764 bbl., but output is estimated to be 7.5 per cent below allowables.

Estimated daily production beginning August 1 will be 2,382 bbl. more than has been certified for the month by Petroleum Administration for War, but production of 145,357 bbl. daily of distillate and natural gasoline in addition to crude oil will place the total output of petroleum liquids in this state at 2,246,739 bbl., or 9,739 bbl. more than the over-all August certification of PAW.

Next month's schedule permits 24 producing days for the East Texas field, one more than permitted this month; no shutdown days for the Panhandle compared with 27 producing days in effect this month, and 24 general producing days, unchanged from this month.

More producing days were permitted to meet added demand which PAW said was necessitated by war and essential civilian needs. Texas oil production has increased more than 1,000,000 bbl. daily since April 1942 as a result of war demands.

WILDCAT COMPLETIONS AND DISCOVERIES

	Week ended July 22, 1944					Cumulative total, 1944				
	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
Ohio	0	0	0	3	3	0	0	9	41	50
Indiana	0	0	0	2	2	3	0	0	13	16
Illinois	2	0	0	9	11	15	0	0	177	192
Kentucky	0	0	0	2	2	5	0	0	36	41
Michigan	1	0	0	10	11	6	0	2	138	146
Kansas	1	0	0	10	11	32	0	5	238	275
Nebraska-Missouri-Iowa	0	0	0	0	0	1	0	0	7	8
Oklahoma	4	0	0	4	8	34	0	17	136	187
Texas:										
North Central	3	0	0	10	13	37	0	1	159	197
West	0	0	0	1	1	16	0	3	93	112
Panhandle	0	0	0	1	1	0	0	0	5	5
Eastern	0	0	0	0	0	4	0	1	74	79
Gulf Coast	1	0	1	8	10	23	5	11	119	161
Southwest	1	0	0	2	3	17	4	11	132	164
Total Texas	5	0	1	22	28	97	12	27	582	718
Louisiana:										
Northern	0	0	0	2	2	3	0	0	31	34
Southern	0	0	0	0	0	4	6	0	32	42
Total Louisiana	0	0	0	2	2	7	6	0	63	76
Arkansas	0	0	0	0	0	2	1	0	30	33
Mississippi	0	0	0	3	3	2	0	0	36	38
Alabama-Georgia-Florida	0	0	0	3	3	2	0	0	12	14
Montana	0	0	0	2	2	2	0	1	17	20
Wyoming	0	0	0	1	1	10	0	1	9	20
Colorado-Utah	0	0	0	0	0	2	0	0	21	23
New Mexico	0	0	0	0	0	3	0	1	35	39
California	0	0	0	10	10	3	0	5	115	123
Total United States	13	0	1	83	97	226	19	68	1,706	2,019
Total previous week	6	2	2	46	56					

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IN PEACE—IN WAR

'BESTOLIFE Lead Seal Joint Compound has been used successfully in the Oil and Refining industries for the past fifteen years. During that time, it has proved itself superior in protecting threads and in providing tight joints which can be broken easily.

Today, 'BESTOLIFE has enlisted in the Navy, Merchant Marine and Defense Plants for the duration, and we are proud of this assignment to help in the Victory effort.

But there are still ample stocks of 'BESTOLIFE available on any priority rating, at supply house field stores in every drilling district in the United States and Canada. Use 'BESTOLIFE Tool Joint Compounds for best results!

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Elevators

Type C

Automatic opening and closing speeds up round-trip time. Self-locking latch freezes latch in closed position when under stress. Light weight with great strength. Regular and upset types for either drill pipe or tubing.

SEE COMPOSITE CATALOG—
PAGES 3101 to 3120

WEB WILSON
Oil Tools
W. W. WILSON BUILDING
HUNTINGTON PARK, CALIF.

Among the

Drilling Contractors

Oil Producers, Inc., will drill 1 Amborski, in SE SE SE 32-4n-12w, Allegan County, Michigan, for Carl E. Grimes, Grand Rapids. This location is in the Hilliard field.

Jack W. Frazier, Houston, has been awarded the contract for a 6,000-ft. wildcat in the Fresno area of Brazoria County, Texas, staked by H. C. Cockburn and associates. The test is 1 B. H. Lattner, in the SE cor. Section 78, H.T.&B. Survey.

George P. Livermore, Inc., is the contractor on a 7,250-ft. wildcat which Woodley Petroleum Co. of Houston has staked in southeastern Lamb County, Texas. This test, 1 W. E. Bird, is in the C NW SE Section 66, Block T, in the T. A. Thompson Survey. The location is 7½ miles northwest of Humble Oil & Refining Co. 1 Jackson, active wildcat, and 7 miles southeast of Stanolind Oil & Gas Co. 1 Hopping, which was completed dry at 9,624 ft. in 1942. It is on a block of about 8,000 acres.

Mealy-Wolfe Drilling Co., Tulsa, is the contractor on W. N. Dannenburg and Creekmore-Rooney, Inc., 1 Thatcher, in the South Wetumka pool, Hughes County, Oklahoma, which set pipe last week at 3,087 ft. The 1 Thatcher, in NW NW 35-9n-10w, is a direct south offset to the Cromwell sand discovery well. The Cromwell pay is around 3,170 ft.

Nelson Drilling Co., Hutchinson, Kans., completed as a dry hole its 1 Shutte, in the C S½ SE SW 3-15-22w, a wildcat in Trego County, Kansas. The hole was carried to 4,275 ft. No shows were reported.

Muskegon Development Co., Muskegon, Mich., has the contract to drill 4 Maurice A. and Flora B. Arms, in the C NE NE SW 7-14n-6e, for United Drillers & Producers, Inc., Lansing. The test is in the Essexville field, Bay County, Michigan.

West Central Drilling Co. has spotted its 1 Mrs. Jessie Brown et al, which it will drill for its own account, 600 ft. from the west line and 1,400 ft. from the south line of Section 34, Block 17, T.&P. Survey, north of Tye, in Taylor County Texas. There are 1,000 acres in the block.

Ferguson & Shaffer have received from Russell E. Shaffer, Standish, Mich., the contract for drilling a well, 1 Carl Ricker, in the SW NE SW 27-2n-9w, Hope field, Barry County, Michigan.

J. W. McIntosh, Mount Pleasant, Mich., is moving in cable tools for the Harold C. Bishop 1 Dick, a Clinton sand test in Summit County, Ohio, projected to 3,700 ft.

Cummings & Holland, Houston, have contracted to drill Bishop & Moss 1 Pedro Lopez, a wildcat test in Porcion 88, 1½ miles south of the Ross pool, Starr County, Texas. Contract calls for testing to 3,000 ft.

Trinity Drilling Co., Dallas, was at total depth of 5,270 ft. last week at 4 Shanks, which it has been drilling for its own account in Section 700, Block D, J. H. Gibbons Survey, Yoakum County, Texas. It topped pay at 5,215 ft., acidized and tested 113.52 bbl. of oil a day.

Taggart Brothers Co. is the contractor on a wildcat to be drilled for Sun Oil Co. in Osceola County, Michigan. The test, 1 John W. Seagraves, is in SW NE SW 11-17n-9w.

Young Bros., California drilling contractors, have started active work on a wildcat for O'Quinn & Hadley in the Salton Sea district of Imperial County north of wildcats drilled by Standard Oil Co. of California and Pure Oil Co. at San Felipe and Truckhaven. Carbon dioxide gas is being produced in commercial quantities near the Salton Sea and the current well will be drilled to determine the potential possibilities below this shallow zone.

Kent Drilling Co., Los Angeles, is progressing with a well on the Kraemer property at Richfield which is being drilled under contract for Standard Oil Co. of California.

Bryan Petroleum Corp., Tulsa, began rigging up last week at 1 Zweigel, which it is to drill for Wakefield and Palmer in the Boggy Depot

area of Atoka County, Oklahoma. This wildcat is in NE SW NW of 16-3s-10e.

Stover & Rawlings, Chatham, Ont., have the contract from West Petroleum, Ltd., for drilling 2 West in the bed of Lake Erie, opposite the southern end of the old Tilbury field. Location is 5,950 ft. offshore and 2,500 ft. west of 1 West, drilled by the same firm last year. Preliminary to spudding, 70-ft. piles will be driven for a drilling pier to be constructed in 34 ft. of water, and the well will be carried to around 1,375 ft. for a thorough test of the Guelph-Niagara formation.

NO DANGER—
When Bearings Are Poured With BABBITRITE

Babbitrite never "blows out" because it contains no moisture to generate steam, and does not melt even at high temperatures. Babbitrite "sticks tight" to mold or metal under all working conditions—has strength of body to hold a charge of molten-babbitt.

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UNIBOLT XMAS TREE FITTINGS

(Compared with flanged fittings)

Weigh a great deal less . . . have a substantially higher safety factor . . . and are easier on your pocketbook.

THORNHILL-CRAVER COMPANY
HOUSTON

MARKET QUOTATIONS

Prices as of July 25, 1944

(This service is abbreviated because most refinery products are selling at the Government's price ceilings. Quotations on other products than those shown here furnished on request. Quotations are f.o.b. plant in tank cars and in cents per gal-

REFINERY GASOLINE

Octane (A.S.T.M.):	80†	72-74
Mid-Continent	6.00-6.25	5.750-6.000
Gulf Coast	6.00-6.50	‡5.750-6.250
Northeast Coast	9.80	9.200
California		6.255-6.500

*Basis Oklahoma Group 3. †1939 C.F.R. (research method.) ‡Unleaded.

NATURAL GASOLINE

Grades:	26-70	18-55
Oklahoma (Group 3)	4.750	5.700
North Texas	4.375	5.250
North Louisiana	4.375	5.250
California	4.875	5.500

CRUDE-OIL PRICES

Representative posted schedules per bbl.	
East Texas	$1.25
Conroe	1.43
Tepetate, Louisiana	1.18
Illinois basin	1.37
Pecos County, Texas	.95
Bradford, Pennsylvania	3.00
Van, Van Zandt County, Texas	1.08

Note: Exclusive of subsidy.

A.P.I. REFINERY REPORT

Week Ended July 15, 1944

(Figures in thousands of barrels)

	Dly. crude runs to stills	Stocks: Gasoline	Stocks: Residual	Stocks: Gas oil
Appalachian	167	3,006	477	1,420
Ind., Ill., Ky.	759	18,443	3,783	5,987
Okla., Kan., Mo.	377	6,997	1,547	1,534
Censored area*	2,406	37,112	15,730	19,518
Rockies	116	2,428	632	337
California	750	14,266	32,163	8,375
Total 7-15-44	4,575	82,252	54,332	37,171
Total 7- 8-44	4,645	83,709	53,686	36,189
Total 7-17-43	3,943	75,391	66,871	33,079

*Reports combined on East Coast, Texas Gulf Coast, Louisiana-Arkansas and Inland Texas at request of PAW.

CRUDE-OIL STOCKS

(Bureau of Mines Estimate)

Week ended:	Bbl. of crude*
July 15, 1944	226,513,000
July 8, 1944	226,424,000
July 17, 1943	237,440,000

*Excludes unrefinable California stocks.

CALENDAR

September

A.C.S., 1944 fall meeting, Pennsylvania Hotel, New York, September 11-15.

N.P.A., annual meeting, Hotel Claridge, Atlantic City, N. J., September 20, 21, 22.

October

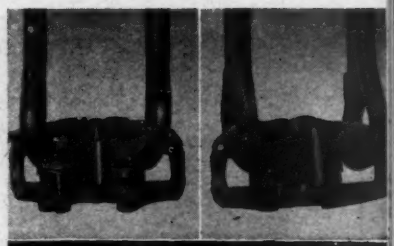
C.N.G.A., annual meeting, Biltmore Hotel, Los Angeles, October 13.

I.P.A.A., fifteenth anniversary meeting, Dallas, Tex., October 23, 24, 25.

November

A.P.I., annual meeting, Stevens Hotel, Chicago, November 13-16.

A.C.S., third national chemical exposition, Coliseum, Chicago, November 15 to 19.



In Either Open or Closed Position

BJ "AA" ELEVATORS ARE REALLY BALANCED

By incorporating a newly devised roller type balancing cam in BJ "AA" Elevators the work of the derrick man is made much easier. Rated at 300 tons, with a safety factor of four to one, this elevator is made of high alloy steel—fully heat treated—flame hardened on the top bore to minimize upsetting—and is equipped with an unusually sturdy latch. Ask the BJ man or your supplier.

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EVERSTICK

For dependable anchoring under all conditions, use Eversticks. Made of tough, rust-resistant, malleable iron . . . quick and easy to install . . . expand in undisturbed earth. Preferred by engineers and crews alike. Write for latest Everstick bulletin.

EVERSTICK ANCHOR CO.
FAIRFIELD, IOWA

PERSONALS

New Vice President In Shell Service 28 Years

F. E. REHM, whose election as a vice president of Shell Oil Co., Inc., was announced last week, has been in the service of that organization 28 years. His first job with Shell was in the production department, at Ventura, Calif. A series of promotions followed, and in 1935 he became production manager. Three years later he was appointed head of the company's industrial relations department, with headquarters in San Francisco.

Since July 1942 Rehm has been manager of the industrial relations and personnel department. He will continue to hold that post, along with his duties as vice president, S. Belither, chairman of the board, said, and his office will remain in San Francisco.

Rehm graduated from Stanford University in 1915. He was active in football and crew. He has a daughter and a son, the latter an ensign in naval aviation.

C. H. Keplinger, who was production engineer for Shell Oil Co., Inc., at Centralia, Ill., has been transferred to Tulsa, where he is acting exploitation engineer for the Oklahoma division.

A. L. Nickerson, formerly general manager of the New England marketing division of Socony-Vacuum Oil Co., Inc., has been made assistant general manager of the eastern division, with headquarters in New York. **L. A. Myers,** who was industrial sales manager of the New England division, succeeds Nickerson.

Clarence E. Wood, who began with Shamrock Oil & Gas Corp. as a pumper 3½ years ago, has been made assistant foreman of lease operation and Panhandle drilling (Gray County, Texas).

Frank and **George Frankel,** Houston oil men, have substantial production on the southeast side of the Fullerton field, in northwestern Andrews County, Texas, and the community which has grown up around their operations has adopted the name Frankel City. Supply companies and oil-field service concerns have opened branches there, and a telephone exchange has been installed, connecting with the town of Andrews. If the Fullerton and Union fields continue to expand, Frankel City is expected to become a center of activity.

Clare D. Wilhelm, production foreman at Brea, in the Los Angeles Basin division, California, for Shell Oil Co., Inc., has been transferred to a similar position at Oilfields, in the San Joaquin division. His place at Brea has been taken by **Weeden J. Reid,** who was production foreman at Oilfields.

Charles H. Cole has been promoted to assistant manager and **Joseph E. Murphy** to general superintendent at Colonial Beacon Oil Co.'s Everett, Mass., refinery. Both were assistant general superintendents, each with certain departments under his supervision. Cole, a graduate of Worcester Polytechnical Institute in 1930, was employed in the Bayway, N. J., refinery of Standard Oil Co. of New Jersey until 1935, when he was transferred to Everett. Murphy, graduating from Northeastern University, started with Colonial Beacon at Everett as a laboratory tester in 1921.

Charles Lummus has been made safety director of The Shamrock Oil & Gas Corp. at Amarillo, Tex. He was formerly with Columbia Gasoline Corp. at Shamrock, Tex.

A. V. Stubenrauch has been appointed manager of a newly established systems and planning division of Sun Oil Co.'s accounting department. The new division will be charged with development and improvement of accounting technique and office procedures. Stubenrauch formerly was personnel manager of Sun's Philadelphia general office.

C. O. Faulk, who was assistant landman for Magnolia Petroleum Co. in the West Texas district, has moved from Midland to San Antonio, where he is district landman for American Republics Corp. Before joining Magnolia Faulk scouted for Tide Water Associated Oil Co. in Mississippi.

M. T. Hartwell, formerly on the geological staff of Buffalo Oil Co. in Midland, Tex., is now in charge of the new geological headquarters established in that town by Snowden & McSweeney Co. Work in West Texas, New Mexico, North Texas, and West Central Texas will be under his supervision.

Alexander G. Bailey, of Montreal, formerly on the executive board of Allied War Supplies Corp., has been named deputy chairman of Petroleum and Natural Gas Conservation Board of Alberta, replacing **Gordon Northfield,** now with the federal income-tax branch. He will have charge of office administration.

W. F. Eiting, Jr., has been appointed division engineer of The Carter Oil Co.'s southern division, with headquarters in Shreveport, La. He replaces **R. E. Watson,** who resigned. A graduate in petroleum engineering at University of Tulsa, Eiting has been located at St. Elmo, Ill., since 1941, as district engineer in Carter's eastern division.

J. W. Ross, manager of the Wichita, Kans., sales division of Standard Oil Co. of Indiana, has been advanced to assistant general manager of the western division, with headquarters in Chicago. He is succeeded in Wichita by **C. H. Lamoreaux,** sales promotion manager in the Chicago office. **W. H. Miller,** assistant manager in Detroit, succeeds Lamoreaux. **W. C. Love,** assistant manager in Saginaw, succeeds Miller. **C. G. Shade,** sales manager at South Bend, succeeds Love. **F. J. Swindell,** formerly assistant general manager of the western division, has been transferred to the eastern division to re-

HOW TO MAKE GAS LIFT WORK BETTER

Gas Lift installations in wells where gas is available have proved to be the most economical method of producing oil. The Halbert Flow-Valve, after more than ten years use in several different fields, has given perfect satisfaction. This valve is different from all others in these design features: (1) Only 1 working part . . . a bakelite float, (2) No diaphragms or springs, (3) No metal parts to wear out or get out of adjustment, (4) Only fluid can operate the float.

A simple and trouble-free installation gives good results on most wells where gas lift is indicated. This is described in detail and illustrated in the free folder.

Cross Sectional View shows the simple design with the float chamber welded to the tubing section of the valve. Below the float, shown in raised position, are the slotted ports for entry of fluid from the annular space; the other port leading down below the seat permits entry of fluid from the tubing. Gas will not operate the float.

WRITE TODAY for illustrated folder of diagrams and installation data. Sent without cost or obligation.

Cross Section View

Halbert Flow Valve Division

PLASTELITE Engineering Co.

P. O. Box 412

FORT WORTH 1, TEXAS

place the late **F. H. Fillingham. W. L. Gross,** sales promoter in the general office, has been named assistant manager at Joliet, replacing **C. B. Evans,** absent from duty on account of ill health. **G. D. Carroll,** sales manager at Saginaw, succeeds Gross.

Hugh M. Stalcup, vice president in charge of production for Skelly Oil Co., Tulsa, has returned to his desk after serious illness.

Henry E. Zoller, Wichita, Kans., formerly executive vice president and general manager of The Derby Oil Co., was elected last week president of both that company and the parent concern, The Derby Oil & Refining Co. He succeeds **Carl Fisher,** who had been president of both companies since 1938. **A. L. Derby** resigned as chairman of the board and gave up his activities as director of the two companies. **E. C. Claiborne,** treasurer, was chosen to take his place in the directorates.

Oakah L. Jones, Tulsa, assistant secretary and assistant treasurer of Oklahoma Natural Gas Co., was elected second vice president of National Office Management Association at its annual conference in New York.

F. W. Bruner, production superintendent of The Carter Oil Co.'s eastern division since December 1942, has been transferred from Mattoon, Ill., to Billings, Mont., as acting manager of the company's Northwest division. He will fill the post vacated by **J. R. McWilliams,** Carter vice president and director, who was granted a leave of absence to become director of the production division of Petroleum Administration for War. **R. J. Sullivan,** assistant division superintendent and division engineer, was named acting division superintendent to replace Bruner in Mattoon. **O. D. Harper,** district superintendent at Carmi, Ill., is transferred to Mattoon to serve as acting assistant division superintendent.

OIL and GAS BURNING EQUIPMENT

NATIONAL AIROIL BURNERS

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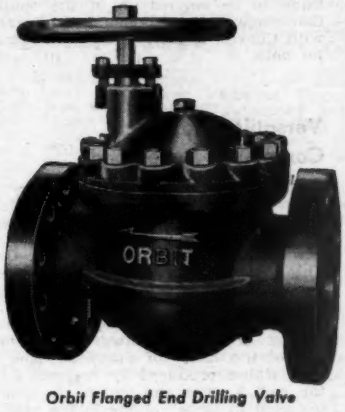
ORBIT

DRILLING VALVES ARE QUICK OPENING

ONLY 2½ to 5 TURNS ARE REQUIRED TO FULLY OPEN OR CLOSE THE ORBIT DRILLING VALVE. THE SEATS ARE PROTECTED AGAINST DAMAGE FROM DRILLING TOOLS AND WIRE LINES.



Orbit Flanged End Drilling Valve

ORBIT DRILLING VALVES ARE AVAILABLE IN BOTH FULL OPENING AND NOMINAL OPENING SIZES. WITH FLANGED OR SCREWED ENDS.

See pages 2194 to 2211 in 1944 Composite Catalog

ORBIT VALVES

OIL WELL IMPROVEMENTS CO.
Since 1912
Tulsa, Oklahoma

Equipment Progress

Pomona Pump Administration Moves to Main Hendy Plant

The chief administrative offices of the Pomona Pump division of the Joshua Hendy Iron Works have been moved to Sunnyvale, Calif., for a consolidation with the general administration of the company. Affected by the change are the sales, engineering and accounting departments.

Among the number of those moving their offices north are Arnold Brown, sales manager; A. W. Moore, advertising manager, and Ralph Linderman, export manager.

All manufacturing activities will continue to be carried on in the southern California plants at Pomona and Torrance, with Charles L. Barrett as plant manager for both.

Versatile Sealing Compound Developed

After several months of laboratory research and development work, Presstite Engineering Co., 3900 Chouteau Avenue, St. Louis, announces the production of a new sealing compound known as Galco. This material is a Thiokol synthetic-rubber compound of the latex type, designed for spray, brush, or slush application.

Galco was developed especially for the sealing of airplane integral fuel tanks, one of the latest of many airplane fuel tank sealers produced by Presstite during the past 3 years and which are now being used in large volume in the vast aircraft production program.

Galco has characteristics that make it suitable for many other uses. It has very low diffusion rate, low solubility in aromatic fuel and water, and very high adhesion to aluminum, steel, wood, and other surfaces. Galco will maintain a tight seal at extremely high and low temperatures.

Fluor Reopens Tulsa Office

Fluor Corp., Ltd., of Los Angeles, has announced it is reopening a branch office in Tulsa immediately. M. A. Ellsworth will be in charge of the Tulsa office and is now completing necessary arrangements for the office location.

The Tulsa office of Fluor was closed soon after Pearl Harbor when it became necessary to transfer the staff to other points in connection with the installations of new 100-octane refineries. Fluor maintains other branch offices in New York, Kansas City, Pittsburgh and Houston.

New Electrode Made For Operation on A.C.

A new general-purpose electrode for mild steel, designated as "Fleetweld 35," and made specifically for operation on a.c., has just been announced by The Lincoln Electric Co., Cleveland.

This new shielded arc electrode, which will also operate on d.c. with either polarity, depending upon the type of work being done, has all the desirable characteristics of the Lincoln "Fleetweld" electrodes for high-speed welding of single or multiple passes for work in flat, vertical or overhead positions.

Available in 1/8", 5/32 and 7/32-in. sizes, "Fleetweld 35" has exceptionally high physical properties, the as-welded weld metal specimens testing as follows:

Tensile strength, p.s.i.	62,000 to 70,000
Yield strength, p.s.i.	52,000 to 57,000
Ductility (elongation in 2 in.),	23 to 30%

"Fleetweld 35" conforms to American Welding Society specifications for arc welding electrodes classes E-6010 and E-6011, is made in the standard 14-in. lengths and is packed in 50-lb. containers.

Becker Named by W.K.M.

Jack A. Becker has been made Tulsa resident representative of W.K.M. Co., Inc., of Houston, it has been announced. The company manufactures oil-field valves, shale separators, and other field equipment.

Kerr Named to Plomb Board

Election of R. W. Kerr to the board of directors of the Plomb Tool Co. is announced by Morris B. Pendleton, president. He will also assume responsibility for the company's sales program.

Entering the credit department in 1938, Kerr became credit manager later in the same year, and assistant secretary shortly afterward. He was appointed treasurer in 1941, which position he still holds in addition to his new responsibilities.

Wynans New Vice President Of Duraloy Co.

Duraloy Co., Scottsdale, Pa., announces the appointment of F. S. Wynans, formerly of the planning staff of Carnegie-Illinois Steel Corp., as secretary-treasurer of the company.

Westinghouse Executive Named A.I.M.E. President

Charles A. Powel, manager of headquarters engineering of Westinghouse Electric & Manufacturing Co., has been elected president of the American Institute of Electrical Engineers for the year beginning August 1944.

Brogan With Bunting Company

Frank J. Brogan has been appointed southwestern representative for Bunting Brass & Bronze Co., Toledo, Ohio. He will be located in Dallas.

A. S. Behrman Joins Velsicol Corp.

Lt. Col. A. S. Behrman, who has recently returned to inactive duty (reserve) status after 2 years of active Army service, has become associated with Velsicol Corp., Chicago, as vice president and director of research. Prior to his service in the Army, Colonel Behrman was for many years vice president and chemical director of Infilco, Inc., also of Chicago.

Army-Navy White Star Is Awarded Hanlon-Waters

M. F. Waters, president of Hanlon-Waters, Inc., Tulsa, received notice this week from Undersecretary of War Robert Patterson that his company had been awarded a White Star for its Army-Navy "E" flag, for "continued meritorious service" in the manufacture of portable pump stations for war use. The company received the "E" flag in a ceremony at the plant last February 28.

Schwenk Elected President Of Busch-Sulzer Bros.-Diesel Engine Co.

Edward B. Pollister, for many years president of Busch-Sulzer Bros.-Diesel Engine Co., has retired, and Norris H. Schwenk has been elected president to succeed him. Schwenk comes to the company with a record of successful management of large business.

Frank Wheatley, Jr., Joins U. S. Army Air Corps

Frank Wheatley, Jr., vice president and general manager of Frank Wheatley Pump & Valve Manufacturer, is in the U. S. Army Air Corps and stationed at Sheppard Field, Texas. The Wheatley company were subcontractors on the portable pipe line, an important new weapon of the armed forces of the nation on foreign battle fronts, and has been familiar with the development of the Sydney S. Smith project since its inception in 1941.

Joins Inco's Technical Service Group

H. O. Teeple, chemical engineer, has joined the technical service group of the development and research division of International Nickel Co., Inc., at New York. He will specialize in corrosion problems.

Trade Literature

Norton Electrical Instrument Co., Manchester, Conn.—A handsome booklet entitled "Norton Folks Contribute to Industry," designed with the objective of making employes, particularly the newer ones, more familiar with the types of products they are producing, and their field of application.

Air Reduction, 60 E. 42nd St., New York 17, N. Y.—A pocket-size, slide-type guide that shows proper tip sizes, gas pressures, and other data required for machine gas-cutting steel of various thicknesses with two of the company's gas-cutting tips.

Jessop Steel Co., Washington, Pa.—Booklet on cast-to-shape tool steels, describing their manufacture and applications.

Builders Providence, Inc., Providence, R. I.—Bulletin 350, describing the company's Propelflo meter, the direct-reading, propeller type for main-line metering.

Classified Advertising

UNDISPLAYED RATE

8 CENTS A WORD, minimum charge $2 per insertion.

SITUATIONS WANTED, 4 cents a word, minimum charge $1.

BOX NUMBERS, count 8 words when replies are to be sent to our Tulsa Office.

10% DISCOUNT if 3 insertions are ordered at one time, with check accompanying order.

All classified advertising payable in advance.

DISPLAYED—PER INCH

Classified display advertising set in single or double column style:

1 inch	1 time	$7.00
1 inch	13 times	6.50
1 inch	26 times	6.00
1 inch	39 times	5.50
1 inch	52 times	5.00

Rates are governed by total space used within 12 months from date of first insertion. Credits are allowed when lower rates are earned.

FORMS CLOSE 9:00 A.M. MONDAY
Advertising will be accepted in order received, to extent of available space.
Published Each Thursday

ROYALTIES

ANDREW J. BARRETT
The Philtower
Tulsa, Oklahoma

OIL REPORTS

GEORGIA OIL REPORTS: 6 mo. sub. $6. Get posted. Keep posted. Also Base and County maps So. Ga. and North Fla. C. W. Deming, Waycross, Ga.

FOR SALE — MAPS

MISSISSIPPI-ALABAMA BASE MAP
Scale 8 miles to inch. Size 4½ ft. square. Includes Florida Panhandle and eastern Louisiana. Shows County names, County Seats, all oil development, depths dry holes, who drilled them, names of fields, many prospects. Also 16 major anticlines and faults and principal surface geologic contacts in both States from authentic sources. Price $15 paper, $20 linen. Individual field maps on all Mississippi fields showing everything $3.50 each. Also complete coverage County and Parish maps in South Texas and South Louisiana, many County maps in Mississippi. All fields above area numbering 723 now mapped, $3.50 each.

ZINGERY MAP COMPANY
Houston 2, Texas

WANTED

WANTED: DRILLING CONTRACTOR with cable and rotary equipment for 1500 and 6000 foot drilling South Dakota Wildcats, on semiturnkey contracts plus bonus interest in wells 7 lease spread. References exchanged. Write Box C-982, The Oil and Gas Journal, Tulsa, Okla.

DRILLING CONTRACT
Arizona Group seeks connection with a reliable drilling company to drill a test well near Holbrook, Arizona. Estimated depth, 4000 feet. Write to Box 4039, Los Angeles 24, Calif.

LEASES AND DRILLING BLOCKS

FOR SALE: In oil and gas bearing territory, Clinton sand formation, state of Ohio. Well now drilling should be in sand within 25 days. 8500 acres for sale. Adjoining acreage $3.00 per acre, balance at $1.00 per acre. Write or wire Wally Davidson, 356 Mt. Vernon Road, Newark, Ohio.

10 Bbl. settled production, 4 wells, equipment, 470 acre lease, 1200 ft. Bartlesville sand in Washington Co., Okla. Box C-984, The Oil and Gas Journal, Tulsa, Okla.

LEASES AND DRILLING BLOCKS

NEW MEXICO
State Oil and Gas Leases

Located in the Great San Juan Basin. Oil pools now producing highest gravity crude known. HELIUM discovery. DEEP TEST UNDER WAY. Buy where the majors buy. Write for information. Harry S. Wright Wright Bldg., Farmington, New Mexico.

DESIRABLE OIL LEASES, in shallow territory. Numerous exposures show this acreage to be on a large dome. Located near Columbia, Ky. Will give acreage for a test well, or will sell. State Highways and W.P.A. roads make this acreage easily accessible. For further information write J. H. Goff, Columbia, Ky.

EAST TEXAS — 2,000-acre block. Core drilled. Immediate area shows oil and gas in Woodbine, Paluxy and Travis Peak. 3000 feet tests, all formations. $5.00 per acre plus ⅛ override. Commence well in 45 days. Please do not inquire unless personally financially able to purchase and drill well. Owners, Box C-975, The Oil and Gas Journal, Tulsa, Okla.

PROTECTION ACREAGE WANTED
Have client in the market for single leases or spreads around wildcat wells. Address Box C-979, The Oil and Gas Journal, Tulsa, Okla.

FOR SALE: Oil and gas leases in shallow producing territory of Kentucky; on structures and near producing wells. W. P. Harley, Bowling Green, Kentucky.

We believe we will open up one of the largest oil and gas fields in this country, in extent equal to or larger than the famous northeast Texas field. Ideal geological structure. Geophysical tests indicate caprock and porosities at six different intervals ranging from 1250 to 5500 feet from the surface. Oil seeps in many wells drilled in the locality for irrigation water indicate the presence of an oil pool and we believe we have located the right spot to drill. Have lease assignments for sale on offset and nearby acreage to drilling location at prices inducive to investors and will give acreage to independent and major oil companies for bottom hole money. All leases are taken on the Producers Special, Form 88, 10 year duration with 10c per acre annual rental but perpetual and rent free as long as oil or gas is produced. The field was geologized by the P. H. Lund Engineering Company who has had more than 35 years of practical and successful experience in oil field development. Write for free Booklet containing "Engineer's report excerpts and oil and gas development possibilities in Arizona." Address the Engineering Company, Route 10, Box 981, Phoenix, Arizona.

LEASES ROYALTIES
PRODUCING OR NONPRODUCING
Texas, New Mexico, Oklahoma, Louisiana and Illinois
Inquiries Invited
B. D. BUCKLEY
60 Broadview Drive, Clayton
St. Louis, Mo.

EQUIPMENT WANTED

WANTED: Corrugated fire barrel for Marine boiler, 14 feet long, inside measurement 40¾ inches low, 37⅝ inches high. Clark's Super Gas Co., Box 336, Marrero, La.

WANTED TO BUY: Two new style Askania Magnetometers. Address: Sidney A. Stubbs Oil Properties, 119 East Park Avenue, Tallahassee, Florida.

ROTARY drill, truck mounted, chain pull down, for core hole or seismograph drilling. Will rent or buy. Simplex Co., 1350 Howard Ave., Phone 3-2157, Burlingame, Calif.

WANTED: Vacuum Lubricating Plant, 100 to 500 bbl. capacity. Give full description including age, condition, location, and best cash price. Box C-973, The Oil and Gas Journal, Tulsa, Okla.

EQUIPMENT WANTED

WANT TO BUY: Single or double drum well-servicing unit. Melton Machinery & Supply, Seminole, Okla.

EQUIPMENT FOR SALE

FOR SALE: Mast Pole Rotary Rig, complete with 2,800' 4" drill pipe. Now drilling in Jones County, Texas. U. S. Machine Shop, Electra, Tex.

1—K-53 Portable Reverse Clutch
1—54" 4 Sheave Regan R B Traveling Block
1—5 in line R B Gumbo Buster Crown Block
1—6" 6 speed Gumbo Buster R B Draw Works
Drawer 512, Edmond, Okla.

18,000 feet 4½" pipe, Hughes Full Hole Flash Weld Joints.
3—125 HP 350 WP Donovan Boilers.
1—1½ KW Generator, Direct Connected 7½ HP Briggs-Straton Gasoline Engine.
Several large complete steam drilling rigs.
JAMES W. LOMAX
506 ESPERSON BLDG.,
HOUSTON 2, TEXAS

FOR SALE: New hydraulic casing pulling pump, Wilson super servicing unit, complete with tools, mounted on International tandem truck; Diamond T pump truck for cementing; D 35 International winch truck; 1941 Ford winch truck; 1940 G.M.C. truck with 1,050 gallon tank; 1941 International pickup truck; miscellaneous tools and supplies for casing pulling. Located at Fairfield, Ill. Write or phone Burgess, Loy & Burgess, Attorneys, Fairfield, Ill.

FOR SALE: At Pampa, Tex., 1—84' American Steel Angle Iron Pumping Derrick, K.D., $450. 6—Erected 94' American Angle Iron Rotary Drilling Derricks, 333,000# capacity with Pumping Crown Block, $600 each. Cities Service Oil, Patridge, Bartlesville, Okla.

APPROXIMATELY 90 wells, etc., in Nowata County, about 600' deep, containing 6¼" casing; 6 wells contain tubing. 1 Model W. Allis Chalmers tubing and rod cleanout machine. 1—1940 Ford pickup. 1—1940 Dodge truck with trailer, good tires. Must be sold all together subject to prior sale. $9,500. Box 574, Tulsa, Okla.

FOR SALE: Practically new Lamtex Casing Pump for 5½" o.d. casing, capable of handling around 600 barrels or more fluid under maximum pumping stroke and length. M. Shields, 609 Gulf States Bldg., Dallas, Tex.

FOR SALE: One Worthington Horizontal Duplex Power 5½x10 Pump Type KPS-1 with or without 80-hp. Bessemer Gas Engine. Dean Bros., W. T. Waggoner Bldg., Fort Worth, Tex.

TANK PLATES
1000 Ton Grade A Steel, 5' x 19', 7/16" 1/2" 9/16". Will pass any inspection. Immediate delivery. Pickens & Bender, 1406 Magnolia Bldg., Dallas 1, Texas.

AT our Oklahoma City Warehouse, 1—Ideco Portable Cleanout Rig, Serial #381307. Price $500. Cities Service Oil, Patridge, Bartlesville, Okla.

RADIATORS
ALL MAKES OF ENGINE COOLERS—AUTOMOTIVE, DIESEL AND INDUSTRIAL RADIATORS
Cleaned — Repaired — Recored
Now able to furnish copper cores on all types of radiators
FRANKS RADIATOR SERVICE
1513 E. 11th St. Phone 3-3820
Tulsa, Okla.

FOR SALE—REFINERY EQUIPMENT
from one of the largest refineries on the Pacific Coast
For Catalog, wire or write
ROUSE & ROUSE
1228 So. Main St., Los Angeles 15, Calif.

FOR SALE: 4—Cooper Gas Engine Gas Compressors. Size 18" x 20" Type 75. 15, 16, 16½ and 17½ inch compressor cylinders. Good condition. Dismantled and ready for shipment. The Globe Oil and Refining Company, Lemont, Illinois.

STILL TUBES

84—3½" O.D. x 3" I.D. x 30' New—B & W Croloy #5 Tubes 4-6 Chrome. ½% Moly—$170.00 per hundred feet.

111—3" O.D. x 2¼" I.D. x 18'6" used Tubes—Carbon Steel—60c per ft.

179—4" O.D. x 3" I.D. x 27'6" used Tubes—Carbon Steel—75c per ft.

84—2⅞" O.D. x 2½" I. D. x 19'8" used Tubes—Carbon Steel—40c per ft.

Large Quantities of Headers and Junction Boxes. All Sizes and Types. Wire, Write or Phone

Refinery Equipment Inc.

W. C. Berry
Union Ave. at 21st. St.

Robt. W. Duden
Tulsa, Oklahoma

FOR SALE: 72 Beaird Steel Headers, 4" I.D., 2000 lbs. test press; 30 Brewster Steel Headers, 4" I.D., 3000 lbs. test press; 30 B.W.Y. C.R. Headers, 4" I.D., High Pressure. ARROW PETROLEUM CO., Centralia, Illinois.

FOR SALE: 9000 ft. extra good Used Reda Cable, priced reasonable. Big saving to Reda Pump Users. Leonard Smith, 1526 N.E. 19, Oklahoma City. Phone 5-0841.

4 COMPLETE steel angle iron Parkersburg and Lee C. Moore 80' Drilling rigs. Manufacturers' original rating 244,000 pounds. Rigs equipped with chain driven sand reels, calf wheels, safety platforms, 4 sheave casing tops, 5" rig irons, steel beams and Pitman, complete foundation, belt house and engine house. Price $3,500.00 each f.o.b. cars located near Charleston, West Virginia. Address inquiries to Box C-918, The Oil and Gas Journal, Tulsa, Okla.

FOR SALE: 5,000' 4½" OD 16.60# Range 2 drill pipe with regular tool joints; 6,100' 4½" OD, 16.60# Range 2 drill pipe with A.P.I. F.H. tool joints. Also 1 steel drilling rig complete with boilers and drill pipe capable of drilling 6,000'. Wire, write or phone Louisiana Iron & Supply Co., Shreveport, La.

FOR SALE: Reconditioned cast iron and steel valves. Also large stock of fittings. Apex Iron & Metal Co., 2204 South Laflin St., Chicago 8, Ill.

FOR SALE at Pampa, Texas: 2—Braun 1-80 Type ETI Horizontal Gas Intercoolers. Cities Service Oil, Patridge, Bartlesville, Okla.

FOR SALE: One 250 H.P. Heine Boiler, Two 300 H.P. Cochrane Heaters, Jenkins Cracking Unit, Winkler and Koch Tube Still, 5 Complete Bubble Towers 5'x30'x⅜", Four 500 bbl. Stills, Steel Buildings, Tanks, Two 8 Ton Gray Towers, Agitator, 10 Condenser Boxes, High Pressure and Standard Fittings, Steam Pumps. Omar Refining Company, Garber, Oklahoma.

FOR SALE: 2 Power Drilling Rigs complete with Lee C. Moore 96-ft. cantilever drilling derrick, less drill pipe. Capacity 4,000 ft. Both rigs running at present. Phone Fairfax 2904, Houston, Tex.

FOR SALE: 10 000 ft. 3½" O.D. 4.5# Used Plain End Line Pipe in 40-ft. lengths. 5.000 ft. 7" O.D. 17# Used Plain End Line Pipe in 20-ft. lengths. Utility & Industrial Supply Company, Jackson, Michigan.

National Transit Vertical Triplex 4½ x 18 Oil Pump 80 HP. Oil Engine. Sale cheap. IVERSON TOOL COMPANY, Tulsa, Okla.

FOR SALE: Caterpillar 96 HP—4 cylinder Natural Gas Engine. Very little usage—steel channel—outboard clutch with pillow block group—oil filter system—Jacket water tank and water pump. 37 KW AC 110-220 Volt. 60 cycle. 3 phase belt driven generator—Power Panel with voltage regulator. Will sell units separately or together. If interested write for further details. O. K. McCullough Company, 15 West 10th St., Kansas City 6, Missouri.

COMPRESSORS—RESHOPPED

3—80 HP Clark direct driven with choice of 5½, 6, 7¼, 12, 13 and 18" x 20" compressor cylinders. 1—10 x 4¼ x 10 Ingersoll-Rand. 1—11 x 5 x 12 Chicago Pneumatic. Spare 5½ and 16" Cooper, 6¾" Bessemer Compressor Cylinders.

Stefco Sect. Steel Buildings
1—30 x 160 x 12. 1—20 x 27 x 8.
1—20 x 56 x 10 Boiler House.

Gas Engines—Reshopped
25, 40 HP 2 cycle, 25 HP 4 cycle Superior, 30 HP Tico.

Centrifugal Pumps—Reshopped
5" Union, 3" Goulds, 1" F-M

NOLAN SALES CORP. TULSA, OKLA.

12,000' 2½" Upset seamless tubing, 4,000' ⅞" sucker rods, 4,000' ¾" sucker rods. Write, wire or phone Melton Supply Co., Seminole, or Murray Tool & Supply Co., Tulsa, Okla.

3 COMPLETE steel rig fronts, 40 hp. superior engines. 2—500 bbl. steel bolted tanks. Write, wire or phone, Melton Supply Co., Seminole, or Murray Tool & Supply Co., Tulsa, Okla.

2—Used 100 Ton Watson-Stillman Outside Pump Hydraulic Jacks, Fig. H-620-A, National Catalog, 12" Max. Rise. Price $200 each or $350 for both. Cities Service Oil, Patridge, Bartlesville, Oklahoma.

50.000' 6⅝" Casing Lapweld, 3,000' 18" O. D. P. E. Lapweld Pipe, 7,500' of 5⅜" O. D. 30' Drill Pipe, good condition, 18" Wilson Snyder High pressure steam pump. A. A. Gilbert Pipe & Supply Co., Shreveport, La.

FOR SALE by East Texas Independent Producer: 2—25-HP, IDECO pumping units complete with Fairbanks-Morse 20-HP. Type Z engines, 11,000 feet 5½" 14# Seamless casing, 2" and 2½" tubing, Sucker Rods, 87' Galvanized and Painted Derricks, lease tanks, and flow lines. All in excellent condition and reasonably priced. Box C-940, The Oil and Gas Journal, Tulsa, Okla.

FOR SALE: Complete heavy duty diesel powered rotary drilling rig. Cummins Diesel Engines—one new, one reconditioned. Emsco Draw Works, Gumbo Buster Pump, two Steel Derricks. All equipment has been reconditioned. This rig suitable for drilling down to 9,000 feet. Byrne Drilling Contractors, 1310 First National Bank Bldg., Dallas 1, Texas. Central 7987.

STORAGE TANKS

Large quantity available from Tank Cars. 8000 and 10000-Gallon capacities. Cleaned—Tested—Painted

SUITABLE FOR STORING MOST KINDS OF LIQUIDS!

Whole tank cars too for mobile storage.

Send us your inquiries for other sizes also!

IRON & STEEL PRODUCTS, INC.

39 years' experience

13412 S. Brainard Ave., Chicago 33, Ill.

"*ANYTHING* containing IRON or STEEL"

100 JOINTS 4½" o.d. 16.60# seamless interior upset drill pipe range 1 left hand threads and couplings, practically new. 7,000' 18" o.d. plain end 58# used pipe lapweld. A. A. Gilbert, Pipe & Supply Co., Shreveport, La.

FOR SALE: 5 Type Eight Bessemer Gas Engines with new type power cylinders. Can furnish compressor cylinders in sizes from 6¾" to 17½". Guaranteed as good as new. Will take payment out of production if deal is sound. Arab Gasoline Corp., Eastland, Texas.

FOR SALE: 3 150HP-350WP Donovan Boilers, 3 125HP-350WP Oilwell Boilers. Oil Field Tool & Supply Co., P.O. Box 2581, Houston 1, Tex.

FOR SALE at our Oil Hill, Kans., warehouse, 1—approx. 5,000' 1" 6 x 19 Union Hemp Center Right Lay Mild Plow Drilling Line, used on one well, $750. Privilege granted of re-spooling before purchase. Cities Service Oil, Patridge, Bartlesville, Okla.

FOR SALE: 2 Ingersoll-Rand vacuum pumps, size 18" x 6", enclosed case, 6" stroke, belt driven, good condition, located Robinson, Ill. American Oil Development Co., Oliver Bldg., Pittsburgh, Pa., or call Tack, 4-8554, Tulsa.

FOR SALE at our Chase, Kans., warehouse, 1—approx. 1,150' 1⅛" 6 x 19 Flexseal Improved Plow Hemp Center Right Lay Union Wire Line, $350. Privilege granted of re-spooling before purchase. Cities Service Co., Patridge, Bartlesville, Okla.

REBUILT EQUIPMENT FOR SALE: TWO ONLY 100-KW Cummins powered generator sets; engines Model LI 6-cylinder 7 x 10 Cummins Diesels, direct connected to 100 KW, 125-KVa, 480-volt 80% power factor 720-RPM Electric Machinery generators. Very modern equipment, completely rebuilt; available with switches, automatic synchronizers and synchrostat if necessary to synchronize both units. Box C-942, The Oil and Gas Journal, Tulsa, Okla.

5—6½ x 20 Ingersol-Rand Compressor Cylinders. 2—5½ x 20 Ingersoll-Rand Compressor cylinders complete. Box C-974, The Oil and Gas Journal, Tulsa, Okla.

1—80.000 bbl. all steel 8-Ring Storage Tank. Dismantle, match marked, and ready for loading. Priced at OPA ceiling, FOB Cars, Sunburst, Montana.

REFINERY EQUIPMENT, INC.
Tulsa, Oklahoma

FOR SALE

Star Spudder #76 with 5" x 7" tools, doghouse, etc. Butane equipped.

BERT MILLER

Fairfield, Illinois

FOR SALE: Wilson Mogul Draw Works with chain transmission, compound and powered by 2 D-13000 Caterpillar Diesel Motors. Complete with Slush Pump Drive. Big Chief Drilling Co. Partnership. Box 387, Salem, Illinois. Phone 1139.

FOR SALE

1,000 barrel Skimming or Topping oil refinery complete in every detail. Ready to operate. Will sell as a whole or any part. Located Pueblo, Colorado.

Many items of used refinery equipment. Priced lower than ceiling. Send us your inquiries.

WANTED TO BUY: Shut down plants or surplus oil refinery equipment.

Brown-Strauss Corporation

Kansas City, 10, Mo. 1402-1740 Guinotte Avenue Phone HArrison 100

HELP WANTED

CHEMICAL Engineer or Chemist to engage in research analytical work with major oil company. Would include some field, some laboratory work. Past experience in high vacuum technique preferred. Position offers good future. Give full personal data, experience and salary desired. Our employes know of this advertisement. All answers strictly confidential. Box C-923, The Oil and Gas Journal, Tulsa, Okla.

MAINTENANCE ENGINEER

Large independent Philadelphia oil compounder, blender and canner offers permanent position to plant engineer. Should be familiar with plant layout, canning operations, materials handling. Man with training and experience in other industrial organizations acceptable. In reply state experience, education, age, marital status, draft classification and salary expected, include small snapshot (not returnable). Replies strictly confidential. Applicants now employed at highest skill in war industries not solicited. Box C-962, The Oil and Gas Journal, Tulsa, Okla.

RESEARCH Geophysicist with several years' experience preferably including field work and laboratory work, to engage in research geophysics with major oil company. In charge of work including evaluation of new ideas and experimental development of some. Position offers good future. Give full personal data, experience and salary desired. Our employes know of this advertisement. All answers strictly confidential. Box C-924, The Oil and Gas Journal, Tulsa, Okla.

WANTED: Mechanical Engineer to take charge of refinery maintenance construction and able to size pumps, exchangers, and coolers. Must have several years practical experience. Permanent position for right man. Salary-Ceiling $400.00 Month. Also want asphalt and water chemist. Box C-944, The Oil and Gas Journal, Tulsa, Okla.

WANTED: Petroleum Engineers and Geologists, with field experience. Excellent opportunity with major oil company operating in Venezuela. Permanent positions. Engineers should be experienced in well completion practice and equipment. Mud control experience valuable. Give age, educational background, experience and marital status to Box C-935, The Oil and Gas Journal, Tulsa, Okla.

ENGINEER or Physicist to engage in study of reservoir performance as related to physical properties with major oil company. Individual should have aptitude and background to enable the mastering of mathematical analysis of problems in flow of fluids. Position offers good future. Give full personal data, experience and salary desired. Our employes know of this advertisement. All answers strictly confidential. Box C-925, The Oil and Gas Journal, Tulsa, Okla.

WANTED: Experienced Petroleum Engineer for Independent Oil Company in Mid-Continent Area. In replying state age, education, experience, salary expected, and any other pertinent information. Address Box C-972, The Oil and Gas Journal, Tulsa, Okla.

WANTED: Superintendent for refinery producing products required by the Government. Prefer technically trained man. High Salary commensurate with ability, will be maintained after the war. Give details of former experience and education. Communication strictly confidential. Address Box C-983, The Oil and Gas Journal, Tulsa, Okla.

WANTED: Experienced refinery chemist. Give references and record of past employment. Box C-986, The Oil and Gas Journal, Tulsa, Okla.

Foreign Employment

The ARABIAN AMERICAN OIL COMPANY is interested in receiving applications from technically trained men with experience in oil field work or in refinery engineering design, construction, or operation, for work in Saudi Arabia. This offers a splendid opportunity for advancement and postwar security, with good working conditions, hospital and medical care, liberal benefit plans, and vacation privileges in the United States.

WRITE OR APPLY to our Relations Department 200 Bush Street, San Francisco 4, California.

HELP WANTED

DESIGNERS
DRAFTSMEN
AND
SQUAD LEADERS

For Process Piping on Oil Refineries.

Applications solicited from men not now employed in essential work or those completing essential work who have Statements of Availability.

ARTHUR G. McKEE & CO.
2300 Chester Avenue
Cleveland, Ohio

SALES ENGINEER to represent us in Mid-Continent territory to promote sale of Unit Pumpers. State age, experience, qualifications in first letter. Box C-976, The Oil and Gas Journal, Tulsa, Okla.

WANTED: OIL WELL CEMENTER with at least three years cable tool and rotary experience. Permanent position with good future. Statement of availability necessary and draft status. Write Dick Allen, Well Service, Inc., 1901 Kanawha Valley Bldg., Charleston 1, W. Va.

SITUATIONS WANTED

ASPHALT CHEMIST. Nine years experience in asphalt manufacture, processing, and research, desires employment with progressive company in this field. Engineering graduate. Age 33. Can obtain release. Box C-809, The Oil and Gas Journal, Tulsa, Okla.

LAND TITLE MAN: Several years' experience with major and independent companies, in office and field. Want permanent connection with substantial, aggressive concern; 37, married, draft exempt. Box C-933, The Oil and Gas Journal, Tulsa, Okla.

POSITION WANTED where initiative and ability are recognized. Degrees in Geology and Business Administration. Geological experience in Kentucky, Louisiana, Michigan, Montana and South America. Read, write and speak Spanish. Experience in Land department proceedure, and scouting. Knowledge of business law. Experience in Appraisals, accounting, auditing and transportation systems. Box C-902, The Oil and Gas Journal, Tulsa, Okla.

ACCOUNTANT or Office Manager with 15 years experience in production, lease, royalty and drilling accounting desires permanent connection with front rank company. Age 40, family, no physical defects. Available in two weeks. Can give best of character and experience references. Box C-960, The Oil and Gas Journal, Tulsa, Okla.

SUPERVISOR, 18 years experience in oil and gas production, gasoline plant, gas recycling, gas measurement, purchasing and office management. Box C-801, The Oil and Gas Journal, Tulsa, Okla.

CHIEF CLERK, District Production office, 18 years experience in handling all drilling and production reports, some personnel and safety experience, desires connection with progressive organization with opportunity to advance. Draft exempt. Box C-977, The Oil and Gas Journal, Tulsa, Okla.

ASSOCIATE PRODUCTION ENGINEER. B.S. degree in civil engineering, 1937, 29 years old, married, two children, draft classification 2A. Seven years oil field experience including 1 year refinery construction, 1 year refinery design, 5 years production. Now employed but desire position of more responsibility with good advancement prospects. Prefer production. Box C-945, The Oil and Gas Journal, Tulsa, Okla.

DRILLING AND PRODUCTION Engineer, 17 years operating experience desires to make a change. Age 45, available immediately. Box C-980, The Oil and Gas Journal, Tulsa, Okla.

SUPERINTENDENT: Twenty years experience in Gas Transmission, plant operation, distribution and measurement. Box C-970, The Oil and Gas Journal, Tulsa, Okla.

NINETEEN years experience in lube oil refining. Was in charge of Duo-Sol-Extraction plant for nine years. Also have sales experience. 19 years with last company. 42 years old. Box C-978, The Oil and Gas Journal, Tulsa, Okla.

SITUATIONS WANTED

PETROLEUM ENGINEER, over 15 years experience with a major oil company. Degree equivalent in Chem. Engr. with Geol. as minor. Held such refinery jobs as head cracking plant stillman, resident engr., safety engr., senior and chief inspector. Can qualify to handle any kind of a refinery job old or new process, construction, operation, maintenance. Age 43, family, good health and agreeable. Desire a permanent plant job or a production job. Box C-965, The Oil and Gas Journal, Tulsa, Okla.

WANTED, position as refinery superintendent, 10 years experience construction, treating, operation and refinery inspection. Prefer small growing concern. Available on any notice. Box C-961, The Oil and Gas Journal, Tulsa, Okla.

TAX, Insurance and Public Relations Director. Years of experience as head of department for major oil company equips me to be expert in such matters; also experienced in leasing; wants position with company where aggressive initiative will be compensated. Go anywhere. References from former employer. Box 2133, Tulsa, Okla.

PRODUCTION ENGINEER or Superintendent. Age 52. Twenty-six years' experience. Can take full charge of development and production. Box C-947, The Oil and Gas Journal, Tulsa, Okla.

EXPERIENCED landman, released from army, wants connection with substantial oil company. Any reasonable position acceptable. Address Box C-709, The Oil and Gas Journal, Tulsa, Okla.

PETROLEUM ENGINEER: 4 years general engineering experience—18 years general experience in production. Available immediately, age 39, married, draft status 3A-H. Box C-949, The Oil and Gas Journal, Tulsa, Okla.

MECHANICAL Engineer with 5 years experience in Carbon Black Industry. Experience in process development; pilot plant design and operation; commercial plant planning and design; also some commercial plant supervision. Age 33, married, no children, veteran. Box 985, The Oil and Gas Journal, Tulsa, Okla.

ACCOUNTANT: 23 years experience oil industry, particularly Petroleum Refinery Accounting. Experienced, capable. Can initiate complete accounting procedures. Special knowledge in costs, yields, and economics. Age 47. Family. Excellent health. Can furnish any necessary credentials. Box C-981, The Oil and Gas Journal, Tulsa, Okla.

COMPTROLLER-HEAD AUDITOR-MANAGER—connection desired. 15 years Accounting, Financing, engineering, sales. Training and experience in field and head offices, and field work, covering the exploration, drilling, production, transportation (Pipe line, Barge, Tank Car, Tanker), Recycling and repressuring, regular and 100-octane refining, and marketing departments of petroleum industry. Aptitude for organization and productive management. Interested only in permanent A-1 connection and wish exchange of references and datum. Married, excellent health, not subject to draft. Box C-971, The Oil and Gas Journal, Tulsa, Okla.

PATENT ATTORNEYS

PATENTS, Trade-Marks, Booklet, "General Information Concerning Inventions and Patents" and "Free Schedule" sent without obligation. Established 1915. Lancaster, Allvine & Rommel, Suite 418, Bowen Bldg., Washington 5, D. C.

BUSINESS OPPORTUNITIES

RELIABLE young organization, principals well known in oil industry for integrity. Will finance, aid in development of and market patented or nonpatented product, device or idea related or allied to the Petroleum and Chemical Industry. Replies will be kept strictly confidential. References exchanged if desired. Box C-963, The Oil and Gas Journal, Tulsa, Okla.

FINANCING

CAPITAL SEEKERS — Interested in raising $25,000 or more for a legitimate project should write to AMSTER LEONARD, Fox Theater Bldg., Detroit 1, Mich.

RANCHES AND FARM LANDS

13,000-acre ranch, Cimarron Co., Oklahoma, sweet gas area, new field, three miles of producing well. Will sell ranch, lease or both. John P. Mathis. Phone 5277, Box 1106, Amarillo, Texas.

ADVERTISERS IN THIS ISSUE

Aircraft & Diesel Equipment Corp. 208
Air Reduction Sales Co. 1
Alco Products Division of American Locomotive Company 168, 169
Aldrich Pump Co., The 97
Alice Pipe & Supply Co. 227
Allis Co., The Louis 17, 18
Aluminum Ore Company 53
American Cable Division of American Chain and Cable Co., Inc. Inside Front Cover
American Manganese Steel Div. 194
American Meter Company 64, 65
American Steel & Wire Company 25
Anchor Petroleum Co. 172
Armstrong Machine Works 116
Athey Truss Wheel Co. 15
Axelson Manufacturing Company 21
Baash-Ross Tool Company 150
Baker Oil Tools, Inc. 120
Beaumont Iron Works Co. 91
Beitz, W. H. & L. D. 59
Born Engineering Co. 204
Bovaird Supply Co., The 37
Briggs Clarifier Company 170
Brown Instrument Company, The 20
Buckeye Traction Ditcher Co. 98
Bucyrus-Erie Company 31
Busch-Sulzer Bros.-Diesel Engine Co. 28
Butler Manufacturing Co. 95, 117
Byron Jackson Co. 231
Cameron Iron Works, Inc. 83
Cardox Corporation 106
Caterpillar Tractor Co. 49
Chain Belt Company 71
Chicago Bridge & Iron Company 152, 153
Chicago Metal Hose Corp. 175
Cities Service Oil Co. 220
Classified Advertising 235, 236, 237, 238
Cleveland Trencher Company 105
Climax Engineering Co. 210
Columbia Steel Company 25
Continental Motors Corp. 42
Core Laboratories, Inc. 173
Crane Packing Company 103
Crutcher-Rolfs-Cummings 207
Cummins Engine Co., Inc. 32
Darling Valve & Mfg. Co. 2
Dean Brothers Pumps, Inc. 219
Dearborn Chemical Co. 112
Dehydro Company, The 87
Dodge Division, Chrysler Corp. 110
Dravo Corporation 205
Dresser Mfg. Co., The 81
Eastman Oil Well Survey Co. 174
Edward Valve & Mfg. Co., Inc., The 82
Edwards Co., E. H. 70
Elliott Company 176, 203
Emerol Manufacturing Co., Inc. 225
Engineering Laboratories, Inc. 196
Ensign Carburetor Company, Ltd. 74
Everstick Anchor Co. 231
Farrel-Birmingham Co., Inc. 206
Fawick Airflex Co., Inc. 56
Ferodo Limited 214
First National Bank & Trust Co. of Tulsa, The 217
Floridin Company, Inc. 228
Fluor Corporation, Ltd., The 12, 13
Foote Bros. Gear & Machine Corp. 22
Gardner-Denver Company 109
Gatke Corporation 161
General American Transportation Corporation—Terminal Division 93
General Controls 213
Geophysical Service, Inc. 185
Gott Mfg. Co., H. P. 205
Grancell, I. H. 230
Graver Tank & Mfg. Co., Inc. 102
Gray Tool Company 88
Grinnell Company, Inc. 159
Griscom-Russell Company 202
Guiberson Corporation 86
Haering & Co., Inc., D. W. 187
Hamer Oil Tool Co. 78
Hamner Co., The Leland 19
Haynes Stellite Co. 76
Hills-McCanna Co. 213
Houston Lighting & Power Co. 156
Houston Oil Field Material Co. 47
Hughes Tool Co. .... Back Cover
Hydril Co. 94
Independent Exploration Co. 6
Ingersoll-Rand Co. 63
International Harvester Co. 155
International Nickel Co., Inc., The 118
Jenkins Brothers 35
Jensen Bros. Manufacturing Co. 225
Jerguson Gage & Valve Co. 100
Jones Company, The S. M. 75
Jones & Laughlin Steel Corp. 73
Jones & Laughlin Supply Co. 186
Justrite Manufacturing Co. 213
Kellogg Company, The M. W. 107
Kent Ltd., George. 216
Keuffel & Esser Co. 219
Key Company 29
Kobe, Incorporated 14
Landis Machine Company, Inc. 9
Lane-Wells Co., The 101
LaPlant-Choate Manufacturing Co., Inc. 184
Larkin Packer Company, Inc. 144
Leschen Sons Rope Co., A. 48
Levingston Shipbuilding Co. 103
Leyman Manufacturing Corp. 36
Linde Air Products Co., The 182, 183
Link-Belt Company 5
Lucey Export Corporation 226
Ludlow Valve Mfg. Co., The 205
Lufkin Rule Co. 194
Lummus Co., The 67
MacClatchie Manufacturing Co. 96
Maloney Tank Mfg. Co. .... Front Cover
Manhattan Rubber Mfg. Division 104
Marley Company, Inc., The 4
Marsh Corp., James P. 82
Martin, Black & Co., Ltd. 171
Master Vibrator Co. 200
Maxim Silencer Co., The 7
McCullough Tool Company 43
McEvoy Company 114, 115
McKee & Co., Arthur G. 24
McNamar Boiler & Tank Co. 204
Mission Mfg. Co., The 192
Monsanto Chemical Company 33
Morse Chain Company 77
Murphy Diesel Company 181
Nash Engineering Co. 54
National Airoil Burner Co., Inc. 233
National Bank of Tulsa 180
National Carbon Co., Inc. 66
New Bedford Cordage Co. 227
Nooter Boiler Works Co., John 111
Norvell-Wilder Supply Co. 50
Oakite Products, Inc. 209
Ohio Steel Foundry Co., The 113
Oil Field Tool & Supply Co. 38
Oil Well Improvements Co. 233
Oil Well Supply Company 162
Oils Pressure Control, Inc. 196
Pacific Wire Rope Co. 51
Patterson-Ballagh Corporation 41
Patterson-Kelley Co., Inc., The 201
Pattin Bros. Div. of Acme Fishing Tool Co. 220
Peerless Pump Division of Food Machinery Corp. 209
Penberthy Injector Co. 143
Pennsylvania Salt Mfg. Co. 10
Petro-Chem Development Co., Inc. 188
Petroleum Electric Power Association 177
Petroleum Rectifying Company 16
Phelps Dodge Refining Corp. 204
Pierce Governor Co., Inc., The 61
Pipeline Cleaners Co. 207
Pittsburgh Equitable Meter Co. Inside Front Cover
Plastelite Engineering Co. 233
Powell Co., The Wm. 46
Pritchard & Co., J. F. 89
Products Manufacturing Co. 231
Pure Oil Co. 84
Reed Roller Bit Co., Valve Div. 179
Refinery Supply Co., The 219
Reilly Tar & Chemical Corp. 208
Republic Flow Meters Co. 30
Republic Steel Corporation 26, 27
Rodgers Hydraulic, Inc. 223
Russell & Stoll Company 68
Schlumberger Well Surveying Corporation 52
Seismograph Service Corp. 191
SKF Industries, Inc. 44
Socony-Vacuum Oil Co., Inc. 92
Sperry-Sun Well Surveying Co. 229
Spicer Mfg. Corp. 39
Standard Oil Co. of California 34
Standard Steel Corp. 45
Sterling Machinery Corp. 204
Stratford Engineering Corp. 98
Struthers Wells Corp. 57
Sturtevant Company, B. F. 170
Taylor Forge & Pipe Works 79
Texas Foundries 60
Texas Pipe Bending Co. 203
Thornhill-Craver Co., Inc. 231
Timken Roller Bearing Company 40
Toledo Pipe Threading Machine Co., The 90
Tretolite Company 55
Tri-Lok Company 205
Twin Disc Clutch Co. 72
Tyson Bearing Corp. 85
Union Asbestos & Rubber Co. 60
Union Carbide & Carbon Corp. 66, 76, 182, 183
United States Steel Corp., Subsidiaries 25, 162
United Steel Companies Ltd., The 80
Universal Oil Products Co. 149
Victor Products Corp. 218
Vinson Supply Co. 160
Wagner Electric Corp. 8
Wall-Colmonoy Corp. 228
Warren Petroleum Corporation 164
Western Felt Works 209
Wheatley Pump & Valve Mfg., Frank 3
Whitaker Company, O. C. 222
Wilson Manufacturing Co., Inc. 11
Wilson Oil Tools, Web 230
Wisconsin Motor Corporation 190
W-K-M Company, Inc. 58
Worthington Pump & Machinery Corporation 23

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, General Land Office, Washington, D. C., Notice is hereby given that the lands herein described within the known geologic structure of the Lamb Anticline gas field, Wyoming, are offered to the responsible qualified bidders of the highest cash bonus per acre for lease under section 17 of the mineral leasing act, as amended by the act of August 21, 1935 (49 Stat. 674, 30 U. S. C. sec. 226), in the following parcels: Parcel No. 1, T. 51 N., R. 92 W., sec. 7, lot 8, 50.64 acres; Parcel No. 2, T. 51 N., R. 93 W., sec. 7, E½ lot 15, sec. 18, lots 5, 6, 9, 10, 11, 12, 15, and 16, 340 acres; Parcel No. 3, T. 51 N., R. 92 W., sec. 18, lots 7, 8, and 13, T. 51 N., R. 93 W., sec. 13, E½NE¼, NE¼SE¼, 272.39 acres; Parcel No. 4, T. 51 N., R. 93 W., sec. 13, W½NE¼, NE¼NW¼, SE¼NW¼, 200 acres; Parcel No. 5 T. 51 N., R. 93 W. sec. 11, SE¼NE¼, E½SE¼, sec. 12, SW¼NE¼, S½NW¼, N½S½, 400 acres. Parcel No. 6, T. 51 N., R. 93 W., sec. 1, S½SW¼, sec. 2, SE¼SE¼, sec. 11, NE¼NE¼, sec. 12, NW¼NE¼, N½NW¼, 280 acres. Sealed bids will be received in the office of the Secretary of the Interior, Interior Building, Washington 25, D. C., up to twelve noon August 7, 1944. Bids must be submitted on each parcel separately, but if two or more parcels are awarded to the same bidder they may be combined in a single lease provided the acreage does not exceed 640 acres. Each bidder must submit a certified check or cash for one-fifth of the amount bid payable to the order of the Treasurer of the United States and file the showing of qualifications to receive a lease required by section 7 of Circular 1386. The remainder of the bonus bid and the annual rental at the rate of $1 per acre must be paid, and a $5.000 corporate surety bond must be furnished by the successful bidder prior to the issuance of the lease. The deposits of the other bidders will be returned. The envelopes should be plainly marked "Bid for Parcel No. ——, Lamb Anticline gas field. Not to be opened before noon August 7, 1944." No bids received after the time fixed herein for submitting bids will be considered. The successful bidders will be required to agree not to discriminate against any employe or applicant for employment because of race, creed, color, or national origin and to require an identical provision to be included in all subcontracts. Bidders are warned against violation of section 59, U. S. Criminal Code, approved March 4, 1909, prohibiting unlawful combination or intimidation of bidders. The right is reserved to reject any and all bids in the discretion of the Secretary of the Interior. Fred W. Johnson, Commissioner.